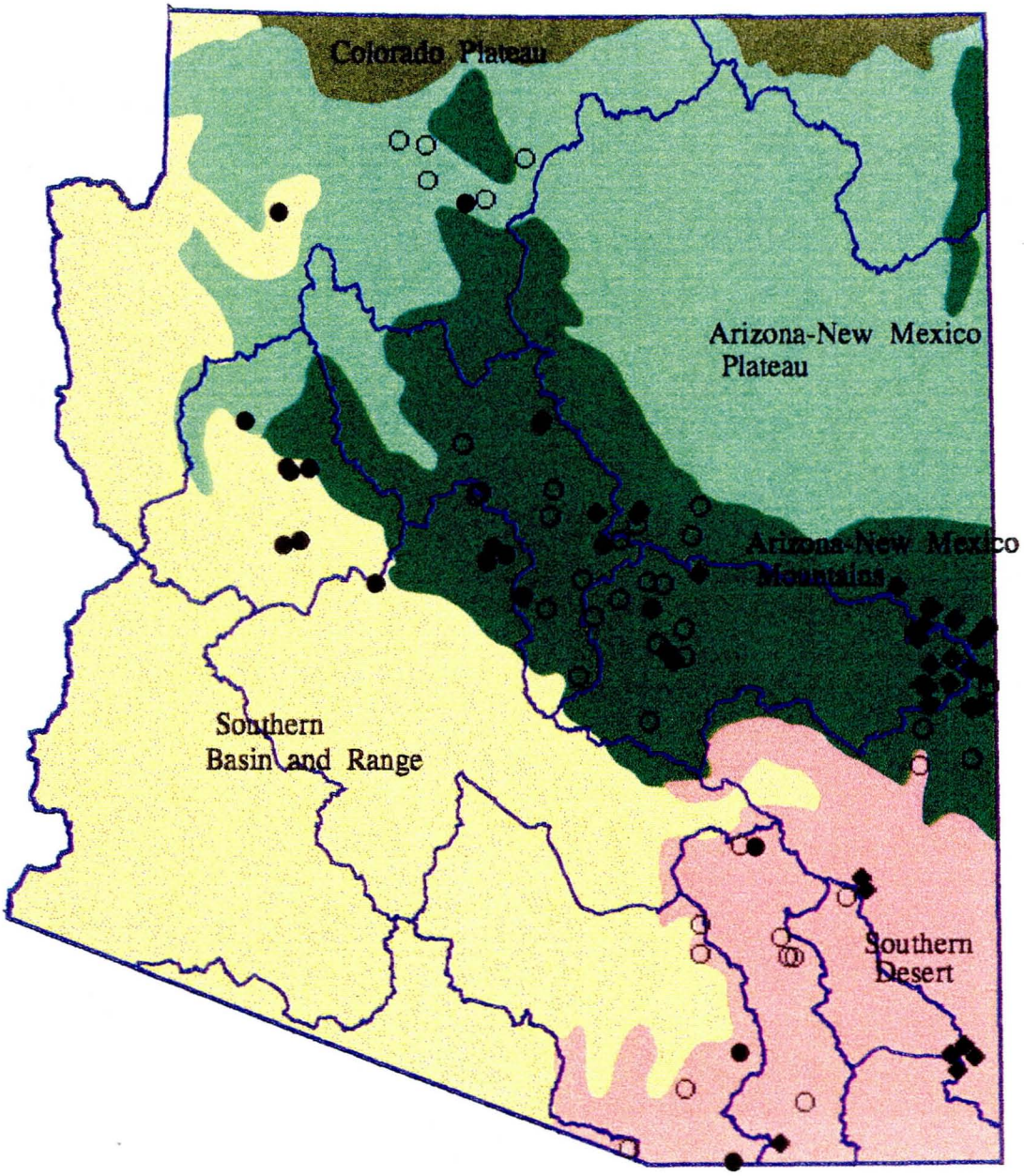
Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

Using Ecoregions for Explaining Macroinvertebrate Community Distribution among Reference Sites in Arizona, 1992



Water Quality Division
Arizona Department of Environmental Quality

OFR 95-7

April 1996

USING ECOREGIONS FOR EXPLAINING MACROINVERTEBRATE COMMUNITY DISTRIBUTION AMONG REFERENCE SITES IN ARIZONA, 1992

FINAL REPORT

Prepared by

Patti Spindler, Aquatic Ecologist
Biocriteria Development Program

Hydrologic Support and Assessment Section
Water Quality Division
Arizona Department of Environmental Quality

April 1996

Acknowledgements

Acknowledgements go to dedicated field hands, support and technical staff, supportive managers and report reviewers. I would like to recognize the dedication and hard physical labor that several field staff persons have put into the sampling program. Richard Meyerhoff, Kyle Palmer, Sam Rector, Lucia Machado and others were key people, without whom the samples from sometimes nearly inaccessible places would not have been collected. ADEQ management has been very supportive of the research efforts of the biocriteria staff. John Wegrzyn, Forrest Woodwick and Richard Meyerhoff were instrumental in getting the program started.

Assistance in statistical analysis of data was provided by several people. Richard Meyerhoff has provided continual support and guidance which has helped shape the direction of the analysis. Tony Villocino's efforts in calculating metrics accelerated the rate of data analysis. Lin Lawson dedicated his time to help me relearn to use SAS statistical software. Charlie Hains has helped with Unix access and SYSTAT software. Thanks also to several report reviewers who gave me invaluable advice: Mike Barbour, Tetra Tech Inc.; Dean Blinn, Northern Arizona University; Kathleen Chavez, Pima County; Susan Davies, Maine Department of Environmental Protection; Leska Fore, University of Washington; Joe Gebler, U.S. Geological Survey; David Herbst, University of California Sierra Nevada Aquatic Research Lab; Robert Hollander, City of Phoenix; Jim Omernik, U.S. Environmental Protection Agency and Linwood Smith, Dames and Moore. Special thanks to Robert Wisseman for technical guidance and taxonomic advice during the course of this study. Internal reviews by several staff pointed out key questions and improved the readability of the report. My thanks for the internal reviews go to Susan Fitch, Wayne Hood III, Lin Lawson, Melinda Longsworth, Diana Marsh, Kyle Palmer, and Dan Salzler. Report production was more efficient due to the efforts of Patricia Mangosing. Cartographic assistance was provided by Victor Gass and Gary McDermott.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

INTRODUCTION 3
- Scope of Bioassessments 3
- Advantages of the biological approach 3
- Bioassessment programs in other states 4
- Previous Arizona studies of Aquatic Fauna 5
- Objectives 5
- Study assumptions 6

METHODS 7
- Sampling Site Selection 7
- Reconnaissance Surveys 7
- Field Sampling Methods 8
  - Macroinvertebrates 8
  - Algae 9
  - Water 9
  - Habitat Assessment 9
- Macroinvertebrate data analysis 9

RESULTS AND DISCUSSION 14
- Ecoregion definition 14
- Multivariate Analysis of Ecoregions 17
- Identification of Important Environmental Variables 21
- Towards an Alternate Classification System 21
- Physical Characteristics of Clusters 26
- Macroinvertebrate Characteristics of Clusters 26
- Important EPT Taxa for Each Cluster 26
- Cluster and Ecoregion Comparisons 32
  - Metric Comparisons 32
  - EPT Comparisons 33
  - Spatial Comparison 34

SUMMARY 37

LITERATURE CITED 39

APPENDICES

APPENDIX A. Geographic and topographic data for Arizona sampling locations, 1992 42

APPENDIX B. Constituents, method numbers and detection limits for stream water samples collected at Arizona sampling sites in 1992 43

APPENDIX C. Habitat assessment and site investigation example field forms:
C1. Biocriteria Site Investigation Form
C2-C4. Habitat Assessment Form 44

APPENDIX D. Habitat assessment scores for Arizona reference sites sampled in 1992 45

APPENDIX E. Relative abundances of macroinvertebrate taxa collected by kick net method from reference site streams in Arizona, 1992 46

APPENDIX F. Water chemistry results for surface water samples collected at Arizona reference sites in 1992 47

APPENDIX G. Physical and chemical characteristics and summary statistics for Arizona reference sites within each of three clusters, 1992 48

APPENDIX H. Thirteen metric scores and summary statistics for macroinvertebrate communities at Arizona reference sites in 1992 49

APPENDIX I. Percent composition of the macroinvertebrate community by insect orders and by functional feeding groups at Arizona reference sites sampled in 1992 50

APPENDIX J. Comparison of box and whisker plots for each of the thirteen metrics by cluster number and ecoregion; a summary of macroinvertebrate data collected at Arizona reference sites in 1992 51

LIST OF TABLES

Table 1. Sampling sites removed from further statistical analyses of macroinvertebrate data 11

Table 2. Thirteen environmental variables selected for regression and correlation analyses 12

Table 3. Characteristics of ecoregions in Arizona 16

Table 4. Cluster analysis results: site list for each cluster, sorted by basin, with ecoregions listed 25

LIST OF FIGURES

Figure 1. Reference biological monitoring sites in 108 Arizona streams sampled in 1992. 15

Figure 2. Results of Detrended Correspondence Analysis (DCA) of 1992 macroinvertebrate abundance at reference sites. Site distribution is represented by site codes. Appendix A lists the corresponding location for each site code 18

Figure 3. Results of DCA for 1992 macroinvertebrate abundances at reference sites. Site distribution is represented by surface water basin codes . . 19

Figure 4. Results of DCA for 1992 macroinvertebrate abundance at reference sites. Site distribution is represented by ecoregion codes. Circled areas indicate two groups of sites within the Southern Deserts ecoregion . 20

Figure 5. Results of DCA of 1992 macroinvertebrate abundance at Arizona reference sites showing the correlation between elevation and axis 1 scores ($R=0.458$, $p<0.001$). Relative size of circle reflects elevation (in feet) 22

Figure 6. Results of DCA of 1992 macroinvertebrate abundance at Arizona reference sites showing the correlation between watershed area and axis 2 scores ($R=0.486$, $p<0.001$). Relative size of circle reflects watershed areas (in square kilometers) 23

Figure 7. Cluster dendrogram results from average linkage cluster analysis of 309 macroinvertebrate taxa at 91 reference sites sampled in 1992 24

Figure 8. Mean physical parameter values of identified clusters at Arizona reference sites, 1992 28

Figure 9. Results of DCA showing the distribution of Plecoptera (stonefly) taxa at 1992 Arizona reference sites with respect to environmental gradients 29

Figure 10. Results of DCA showing the distribution of Ephemeroptera (mayfly) taxa at 1992 Arizona reference sites with respect to environmental gradients 30

Figure 11. Results of DCA showing the distribution of Trichoptera (caddisfly) taxa at 1992 Arizona reference sites with respect to environmental gradients 31

Figure 12. Box and whisker plots of selected EPT taxa at 1992 Arizona reference sites. Variance in taxa distribution among and between clusters and ecoregions is compared (a, *Epeorus*; b, *Amphinemura*; c, Turret cased *Lepidostoma*) 35

Figure 13. Distribution of Arizona reference sites among clusters and ecoregions in 1992. Comparisons of site distribution by cluster and ecoregion groups. 36

EXECUTIVE SUMMARY

The macroinvertebrate community structure was identified for about 100 reference sites statewide in Arizona and the appropriateness of ecoregions for describing different reference communities was assessed. Macroinvertebrate, water chemistry, and geographic data are presented for reference streams sampled in the first year (1992) of the biocriteria development program. The focus of the report was to determine whether the ecoregion concept, developed by Omernik (1987), is the appropriate method for classifying macroinvertebrate communities in small to medium-sized perennial reference streams in Arizona.

Several statistical techniques (detrended correspondence analysis, multiple stepwise regression analysis, cluster analysis, and box and whisker plots) were applied to the data to answer the following questions:

1) *Do macroinvertebrate communities at reference sites naturally group according to ecoregions, based on empirical data?*

   A detrended correspondence analysis (DCA) showed that there are substantial differences in macroinvertebrate community structure within ecoregions, such that one community type would not be representative of the entire ecoregion.

2) *If macroinvertebrate communities do not correlate with ecoregions, then what physical and chemical parameters are most correlated with macroinvertebrate community structure?*

   A multiple stepwise regression analysis identified elevation ($r = 0.458$, $p < 0.001$) as the most important of the 43 tested variables which explains the most variance (21%) among sites. Watershed area ($r = -0.486$, $p < 0.001$) was determined to be the second most important parameter explaining the variance (24%) among sites.

3) *What kind of grouping structure can be determined empirically from the macroinvertebrate dataset?*

   A cluster analysis separated the reference sites into three significant clusters based upon macroinvertebrate structure and abundances. The physical and chemical parameters of these clusters appear to describe three physiographically different zones: a) a montane upland zone, b) a desert lowland zone, and c) a transition zone.

4) *What are the macroinvertebrate characteristics of each cluster?*

   Montane cluster 3 sites contained the greatest number of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa and the greatest percent composition by shredders. The cluster 3 community contained the majority of stonefly taxa, mayflies of the Heptageniidae and the taxa *Ameletus, Ephemerella,* and *Paraleptophlebia*, and many caddisfly taxa of the families Brachycentridae, Glossosomatidae, Lepidostomatidae, and Limnephilidae.

   Desert lowland cluster 2 sites were described by having the greatest percentage of Hydropsychidae, a greater EPT/Chironomidae ratio and greater Hilsenhoff Biotic Index

(HBI) scores than the other clusters. Common but ubiquitous taxa found in desert streams included for example, the mayflies Baetidae, *Caenis, Choroterpes/Thraulodes* and *Tricorythodes*, and caddisflies of the families Hydroptilidae and Hydropsychidae. No stonefly taxa were found in desert streams.

Transition zone cluster 1 sites were described by having fewer EPT taxa, and a greater percentage of the Baetidae mayflies and of Megaloptera and Diptera (dominated by nearly 100 Chironomidae taxa) than the other clusters. In addition, the stoneflies Capniidae and Taeniopterygidae were the most prevalent stonefly in cluster 1 streams in the 1992 dataset. Mayflies found primarily in transition zone streams included *Isonychia, Rhithrogena, Serratella*, and *Traverella*. and several species of caddisflies and the ubiquitous mayflies were also found. Caddisflies of the transition zone consisted of 14 ubiquitous taxa, a montane-transition zone group of taxa (including *Glossosoma*, Hydroptilidae and Limnephilidae larvae, *Micrasema, Phylloicus, Oecetis*, and *Rhyacophila Coloradensis Group* larvae), and a desert-transition zone group of taxa (including *Hydroptila, Leptonema, Leucotrichia, Mayatrichia, Wormaldia, and Zumatrichia*).

5) *How do clusters compare with ecoregions in terms of macroinvertebrate community structure?*

Overall, between cluster variance in metric values was less than between ecoregion variance, indicating that the cluster paradigm describes the different macroinvertebrate communities better than the ecoregion model. Box and whisker plots were used to show that the cluster medians were better separated and the variance was lower especially for the metrics percent Hydropsychidae/total Trichoptera, percent shredders, EPT richness, HBI index, and total richness. The results of this study are preliminary and the physiographic regions described by clusters will be tested with two more years of data. However, at this time, the clusters identified in this report appear to show promise in terms of separating the upland and lowland fauna more accurately than ecoregions.

These preliminary results are from one year of analysis (1992). These analyses and the cluster paradigm will be tested again using the 1993 and 1994 data sets and more definite cluster boundary lines can then be drawn. These clusters appear to show promise in terms of separating upland and lowland fauna more accurately than ecoregions. The new cluster paradigm, if shown to be a reproducible grouping structure, can then be used in the next steps of developing narrative and numeric biocriteria for the surface water quality standards and in performing bioassessments.

While work is ongoing to analyze the 1993 and 1994 datasets, our sampling methodologies and analytical methods are also being studied. Several topics are being researched which will make our sampling strategy more efficient and our assessment method more comprehensive. Example topics for further study include: 1) Are both riffle and pool samples needed from each site? and 2) How does the distribution of algae compare with that of the macroinvertebrates? The Arizona Department of Environmental Quality biological sampling protocol document will be updated with the new sampling protocols generated from these studies.

INTRODUCTION

Scope of Bioassessments

Much work has been conducted during the past decade to develop new methods for assessing environmental conditions and to evaluate the effect of human activities on our natural resources. The publication of Rapid Bioassessment Protocols (Plafkin et al., 1989) provided a standardized, understandable and easy to use guidance for assessing the biological integrity of streams. Unlike previous approaches using indicator taxa of the macroinvertebrate community (e.g. Hilsenhoff, 1988), the Rapid Bioassessment Protocols (RBP) included metrics which incorporated structural and functional aspects of the biological community in a multimetric "score". This score is then used to evaluate the health or impairment status of the stream ecosystem.

Different trophic levels of the ecosystem can be used for bioassessments. Macroinvertebrate and fish communities have been most commonly used and resulting data analyzed with multimetric indices (Karr, 1981; Klemm et al., 1990; Plafkin et al., 1989). However more recent bioassessment protocols developed by Bahls (1993) in Montana and by Metzmeier (1993) in Kentucky, among others, have also addressed the algal component of the ecosystem.

Advantages of the Biological Approach

Historically, indirect chemical methods have been used to determine the health of aquatic ecosystems. Chemical-specific analyses and species-specific toxicity testing are surrogate measures for providing information about the capability of a waterbody to support aquatic organisms. These indirect measures tell us little about the aquatic communities themselves (e.g. their health, abundance, and diversity).

Biological surveys directly measure properties of aquatic communities and are a tool to better assess whether aquatic resources are adequately protected. In our efforts to provide the best protection possible to surface waters in the state of Arizona, it is a logical step to move towards a means of directly measuring the integrity of the biological communities of our streams.

Traditionally, the emphasis has been on pollutants rather than the aquatic resource. Yet it is the resource that needs protection. An environmental protection program that includes emphasis on the direct impacts of pollution will cause a change in focus from the pollutant to the resource. Aquatic biota such as macroinvertebrates and algae reside in waters that receive pollutants and other impacts (e.g. habitat and flow modification, sedimentation , and exotic fish introduction). Consequently, they are long-term indicators of the effects of those pollutants on the ecosystem. A healthy biological community means that we can be relatively confident that water quality management efforts have been successful.

The development of biocriteria does not displace traditional methods for assessing water quality. To the contrary, the best means by which water quality can be protected is to utilize a fully integrated approach for assessing whether designated uses are being met. For example, knowledge of the effects of specific chemicals on the aquatic biota is necessary for regulating point source discharges. However, the effects of complex mixtures and sources of contaminants, such as the synergistic effects of combined

contaminants and nonpoint source pollution, may render chemical tests ineffective in determining impacts. In such cases, direct measures of ambient biological conditions can help determine whether efforts at protecting the environment are satisfactory.

Biological surveys indicate the presence or absence of an impact and in some cases can indicate causes (e.g. fish fin deformities and tumors indicate presence of toxics, loss of suckers indicates sedimentation). But in some cases, the search for the cause and probable source of the pollutant requires conventional physical or chemical methods. Biological surveys can also be used to detect impacts caused by: 1) Multiple or synergistic exposures due to storm events, spills, or the combined effects of point and nonpoint source pollution, or 2) habitat degradation due to poor land use practices. The Environmental Protection Agency (EPA) has recognized that the results of biological surveys of a state's waters are as important for assessing attainment or nonattainment of designated aquatic life uses as are the results of toxicity testing or chemical-specific analyses. Furthermore, Arizona should not only designate aquatic life uses that fully address the Clean Water Act's stated goal of maintaining biological integrity, but biological criteria should be adopted that protect those designated uses. The biological integrity of most of Arizona's waterbodies has not been assessed. The addition of biological assessment to other water quality assessment methods is vital if Arizona intends to protect the biological integrity of the state's waters.

Bioassessment Programs in Other States

Many states have integrated biological monitoring into water quality assessment programs or are researching and developing biocriteria. The following are examples of progress made using biosurveys by states which are in various stages of developing biocriteria, with Ohio, Maine, and North Carolina being the precedent setting states.

The Maine Department of Environmental Protection (DEP) has designed biocriteria based upon macroinvertebrates. Maine DEP developed a multivariate statistical approach called linear discriminant analysis to determine four classes of attainment. These attainment classes are based upon 30 macroinvertebrate metrics (Davies et al., 1993).

The Montana Department of Health and Environmental Sciences has released a report describing the benchmark biology of Montana streams and is working on developing narrative and numeric biocriteria based upon macroinvertebrate and algal communities (Bahls et al., 1992).

The North Carolina Division of Environmental Management has developed narrative biocriteria for macroinvertebrates in three ecoregions using the metrics total taxa richness and EPT taxa richness (Lenat, 1983).

The Ohio EPA pioneered a methodology for establishing biocriteria. A regional reference site strategy was adopted and macroinvertebrates and fish were sampled from best available stream sites in each of five ecoregions of the state. Three biological indices evaluate the biological integrity of streams by comparing to the ecoregion reference condition. They are the Index of Biotic Integrity (IBI) for fish (Karr et al., 1986), the Modified Index of Well-Being (IWB) for fish and the Invertebrate Community Index (ICI). Biological criteria were then developed for each index. Ohio has shown that bio-assessments are cost effective in comparison to chemical specific and toxicity testing

The ecoregion concept has been successfully applied in some states which have large homogeneous landscapes. The large scale features used to define ecoregions are applicable on such large landscapes. However, ecoregions as defined in Arizona, may not be so easily applied because the landscapes within ecoregions are not homogeneous. This study will address the applicability of the currently defined ecoregions in terms of classifying macroinvertebrate communities.

Objective two is necessary because only limited information is available concerning the non-fish aquatic resources of Arizona. We must know what taxa are present and their general distribution in order to use them for the development of biological criteria.

The third objective will help us in our efforts to determine what constitutes a high quality aquatic habitat for biological communities. These biological, physical and chemical attributes will describe the reference or best attainable condition.

The fourth objective is our goal to include biocriteria in the surface water quality standards. The development of narrative biological criteria will be developed on a regional basis if the data show that sufficient regional differences in macroinvertebrate and algae community structure exist. Eventually, with enough data, it is possible that numeric biological criteria can also be developed.

The last objective is the implementation of biological assessments. We must know how the biota respond to different water quality conditions and land use activities. These data will allow us to distinguish levels of attainment of biological integrity in our streams.

Study Assumptions

ADEQ's strategy for performing bioassessments is based upon the EPA Rapid Bioassessment Protocols. The rapid bioassessment protocols recommend a comparison of habitat and biological conditions with empirically defined reference conditions. The reference conditions are established through systematic monitoring of sites that represent the natural range of variation in "least impacted" water quality, habitat and biological conditions. In accordance with this approach, sites have been identified statewide which are thought to represent the best possible and least impacted, although not necessarily pristine, habitats. These sites and the associated macroinvertebrate communities are the baseline for developing standards for surface waters.

There are several strategies for developing reference conditions using control sites: 1) Historical data, 2) a site upstream of a point source, 3) a long-term before-after study, and 4) an ecoregion reference site, among others. We have selected the regional reference site approach as the control condition. The other approaches were rejected because either we don't have historical data to use as a reference, an upstream reference site is not always possible to find because of widespread nonpoint source impacts, or historical data are not available for a long-term study and results are needed within short time frames.

Macroinvertebrates have been selected as the primary group for biological criteria. Algae, especially diatoms, are used as a secondary group. Diatoms were selected as a second biological matrix for analysis because there is a wealth of information about their ecology and because they preserve well. Fish, which are used by other states, are not being used for the following reasons: 1) Fish diversity is naturally low in most Arizona streams, and

methods (Ohio EPA, 1990).

The Washington Department of Ecology has defined baseline reference macroinvertebrate communities for three ecoregions. The metrics of the RBP were applied and multivariate procedures were used to distinguish between sites in different ecoregions (Plotnikoff, 1992).

Previous Studies of Aquatic Fauna in Arizona

In Arizona, studies of the aquatic fauna have focused on species composition. Few studies have actually made assessments of ecosystem integrity and none have addressed the development of regional biocriteria.

Examples of studies of the aquatic fauna of Arizona streams conducted by researchers include: Arizona State University (Boulton et al., 1992; Bruns and Minckley, 1980; Fisher et al., 1982; Gray, 1980), Northern Arizona University (Blinn and Sanderson, 1989; Runck and Blinn, 1993), and by the U.S. Forest Service (Ellsworth, 1994; Mangum, 1990). However, none of these studies have attempted to define regional reference macroinvertebrate communities which could be used for water quality assessment. The Arizona Department of Environmental Quality (ADEQ) has assumed a leadership role in developing these statewide reference conditions and is one of the first states in the southwest to pursue biocriteria development for its surface water quality standards program and for assessing water quality conditions.

Objectives

The objectives of the biocriteria program include the following:

1) Develop a regionalizing concept for determining differences between biological communities at varied reference sites in small to medium-sized perennial streams,

2) Develop an inventory of macroinvertebrates and algae of Arizona,

3) Assess relationships among various habitat and chemical parameters and associated biological communities to better define reference site characteristics,

4) Develop narrative biocriteria for inclusion in the state's rules for navigable or surface water quality standards, and

5) Relate human land use activities to changes in the biological communities to form the basis for bioasessments.

The first objective originates from the need to group or classify reference site biological communities which reflect regional site conditions. It is anticipated that several reference site biological communities will be established to reflect environmental extremes found from the Sonoran Desert life zone to coniferous forests at high elevations. While the diversity of habitats in Arizona may appear too great to allow any regional focus, previous work by the EPA identified five primary ecoregions for Arizona (Omernik, 1987). These ecoregions are based on soil type, vegetation, land surface form and land use.

consequently variations in fish diversity likely will not show the resolution required for biological criteria, 2) native fish populations would provide the best information for comparing impacted and non-impacted sites, but exotic species dominate many Arizona streams, and 3) many Arizona streams are prone to flash-flooding. Natural disturbance recovery times are much more rapid for macroinvertebrates and algae than for fish. Consequently, biological criteria based on fish would not be the best choice in Arizona.

Biological conditions were characterized initially for one of the most heavily used waterbody types in Arizona, perennial waters. Sampling efforts will concentrate on small to medium-sized streams because the sampling methodology and the organisms found in larger streams may differ considerably from small streams. Large rivers and other waterbody types, such as intermittent, ephemeral and effluent dominated waters, may be addressed in the future.

Data will be collected from least-impacted sites for at least three to five years before narrative biological criteria are developed as multiple year data are required to take into account annual variation. Eventually, with enough data, numeric biological criteria can also be developed.

This report is the first of a series of reports that will document the results of the sampling program for each year. This report presents data from the first year of sampling in 1992 and attempts to identify a conceptual framework for regionalizing biocriteria. In future years, the report will be expanded to not only document and analyze new data collected, but begin the process of documenting normal baseline conditions in all streams that are repeatedly sampled.

METHODS

Sampling Site Selection

Reference sites were selected based upon topographical distribution among river basins and ecoregions of the state, historical stream habitat information from various sources, and the best professional judgement of regional biologists. Candidate reference sites were selected to include perennial streams in every major river basin, mountain range, and ecoregion in the state. Documents used to identify candidate sites included the Arizona Water Quality Assessment Report (ADEQ, 1992), the Arizona Water Quality Standards listing of Unique Waters (AAC, 1992), and other agencies' reports such as the Potential Wild, Scenic, and Recreational River Designation Resource Information Report (USFS, 1993). Suggestions for potential reference sites were provided by staff from several resource management agencies such as the Bureau of Land Management, U.S. Forest Service, National Park Service, US Fish and Wildlife Service, Arizona Game and Fish Department and ADEQ. Sites were screened to determine accessibility (most sites were located on public lands) and to ensure even coverage of sites among basins, mountain ranges and ecoregions.

Reconnaissance Surveys

Reconnaissance surveys were performed at about 50% of the potential reference sites to determine their suitability. Surveys consisted of the following activities: 1) Determining that the stream was truly perennial, 2) determining the extent of land use impacts, 3)

ascertaining that channel alterations were minimal, 4) performing a habitat evaluation (based upon a 12 item habitat form developed by the USEPA and modified by ADEQ) to assess the variety and quality of habitat available for macroinvertebrates, and 5) collecting macroinvertebrate samples, identifying organisms to family-level taxonomy and determining the family Hilsenhoff Biotic Index (HBI) (Hilsenhoff, 1988) for the site. A threshold HBI score of about 5.0, on a scale of 0-10, was used to screen sites for use as reference sites. The HBI score, habitat score and qualitative information about the site were then used as screening tools to select the best potential reference sites.

Because reconnaissance surveys were not done for about 50% of the sites, the spring sampling event included much reconnaissance work. Thus not all of the sites listed in Appendix A were predetermined reference sites. As a result of the delayed reconnaissance work, several sites intended to be part of the reference site database were deemed inadequate and were removed from further analyses. However, data for the removed sites is presented in the Appendices.

Field Sampling Methods

Macroinvertebrate samples were collected from 108 sites during the period from April through June of 1992. Spring sampling was selected as the optimum period for collecting samples because many macroinvertebrate larvae are found in their largest stage of development when the organisms are easiest to identify. In addition, this is the time of least disturbance, that is, the potential for flooding and scouring of the biological community is reduced in springtime and increased in winter and summer monsoon periods. Observational data were collected on site investigation and habitat assessment forms. "Grab" water samples were collected for chemical analyses of inorganic constituents and nutrients. Field sample collection methods are fully described in the ADEQ Biological Sampling Protocols (Meyerhoff and Spindler, 1994), followed quality control procedures (QAPP, 1995) and will only be briefly summarized here.

Macroinvertebrates

The sampling strategy for macroinvertebrates followed the Rapid Bioassessment Protocols and focused on sampling the entire range of habitats within each reference site to obtain a comprehensive list of species present. The habitats sampled included erosional (riffle) and depositional (pools) habitats as well as microhabitats (e.g. edge areas, submerged logs, and vegetation beds). Macroinvertebrate sampling consisted of compositing three timed one-minute kick samples collected from three riffle or pool habitats within the sample reach. A D-frame kick net fitted with a 500 micron mesh size net was used for sampling macroinvertebrates. The kick sample was collected by placing the net in the path of flowing water, then agitating the substrate vigorously by kicking or hand turning larger substrates to collect dislodged material. The material was then placed into a water-filled bucket. The process was repeated until all three samples were composited in the same bucket. Microhabitats were sampled by hand picking organisms from microenvironments for 30 minutes. Samples were preserved with isopropyl alcohol and formalin. Contractual taxonomic specialists identified organisms in the macroinvertebrate samples at the lowest taxonomic level possible, usually at least to genus.

Algae

Composited diatom samples were collected from riffle and pool habitats. Samples consisted of composites of algal scrapings from six rocks in each habitat type. Samples were preserved with Lugols solution (APHA, 1989). Diatom identification to genus level was performed by contractual taxonomists. These data are not incorporated into this report but will be reported separately.

Water

Analysis of water included measurements of field parameters on site and submittal of collected water samples for nutrient, metal, and ionic analyses. A Scout 2 Hydrolab multiparameter probe was used to measure water temperature, pH, electrical conductivity, dissolved oxygen, percent oxygen saturation, total dissolved solids and oxidation-reduction potential. Turbidity was measured on site with an HF Scientific Turbidimeter. Grab samples of water were collected upstream of all other activities at the study site. The unfiltered water was placed into pre-preserved one-liter bottles for laboratory analysis of constituents shown in Appendix B. Analytical method numbers and detection limits are also shown in Appendix B.

Habitat Assessment

A habitat assessment was also conducted at the study site. This consisted of two parts: 1) General site information documenting potential nonpoint sources, flooding evidence, presence of wildlife, etc., and 2) a habitat assessment that rates the stream site according to microhabitat, channel morphology, and upper bank characteristics (based on the USEPA RBP protocol for habitat assessments). Habitat assessment forms are provided in Appendix C and habitat scores are provided in Appendix D.

Macroinvertebrate Data Analysis

The focus of data analyses was to develop a regional basis for grouping sites with similar macroinvertebrate communities. Before analyses were begun, certain quality control and transformation procedures were done. The following were done in order to consolidate the species list provided by our contractor. A 400-count subsample of individual insects was the goal for producing the most inclusive and accurate species list. The macroinvertebrates were then identified to the lowest taxonomic level possible, but some refinement of the taxa list was performed before statistical analyses could be applied. These refinements, recommended by our contractor, included: 1) Combining all species under one genus name when some species identifications were tentative (e.g. where mature specimens were not available for positive identification) and 2) Lumping taxa at the family level for families in which the genera could not be consistently identified (Aquatic Biology Associates, 1993). The condensed taxa list is included in Appendix E.

After reducing the taxa list to a level that optimized information and accuracy, taxa lists for riffle and pool habitats were combined in order to analyze the total community structure of both habitats throughout the site. Abundances of organisms in each habitat were weighted according to the relative proportion of the habitat type in the study reach. Then the two weighted abundances were summed. The combined (riffle and pool) abundances of each taxon were then transformed using the natural log transformation

(Ln[x + 1]). Transformations of biological data are necessary before performing statistical tests because abundance data are often not normally distributed (Sokal and Rohlf, 1981).

The site list was then condensed for analysis. Several sampling sites were determined to be heavily impacted in some way or did not fit the description of a small to medium sized perennial stream. Having been the first time many of these sites were visited, it was unknown whether they would be appropriate for use as reference sites. Seventeen sites were therefore removed from further analysis, but the data may be used at a later date for developing impairment categories for metrics as well as for assessment purposes. These 91 sites, their habitat score and the rationale for removing them are presented in Table 1. A complete list of sampling sites listed by basin is included in Appendix A.

Environmental variables were then selected for analysis. The initial 43 variables included: 1) Physicochemical variables: temperature, dissolved oxygen, conductance, pH, and turbidity, 2) various inorganic constituents: total and phenolthalein alkalinity, hardness, total dissolved solids, and total suspended solids, 3) ions: calcium, magnesium, sodium, potassium, chloride, fluoride, bicarbonate, carbonate and sulfate, 4) nutrients: nitrate, kjeldahl nitrogen, and total phosphorus, 5) metals: arsenic, barium, cadmium, copper, iron, manganese, mercury, selenium, thallium, and zinc, and 6) physical parameters: watershed area, elevation, gradient, pool/riffle ratio, relief, upland vegetation type, and primary, secondary, tertiary and total habitat scores.

Thirteen variables were selected from this list to represent a broad range of chemical and physical habitat conditions. The rationale for selection is presented in Table 2. Many chemical variables (nutrients and metals) were removed from the list of 43 initial variables because their values were less than the detection limit. Discharge measurements were not collected in 1992 and are not estimated for this analysis.

Several multivariate analyses were used to determine whether the dataset conformed to Omernik's ecoregions, to identify the most important environmental variables which relate to the distribution of species, and to identify the natural grouping structure of the macroinvertebrates at reference sites statewide. Multivariate analyses are applied to large datasets having a number of variables which may be correlated with the parameter of interest. These techniques can be used in data reduction, that is finding the most important variables among many measured variables, and in grouping similar variables or classifying objects.

Detrended correspondence analysis (DCA) was used to investigate the distribution of 91 sites according to their macroinvertebrate communities (Hill, 1979). This multivariate method produces a scatterplot of sites along two axes which is then interpreted by multiple regression of environmental variables on the axis scores. The site labels can then be substituted with basin and ecoregion codes to determine how well the macroinvertebrate communities grouped. The axes of the scatterplot can then be interpreted by multiple regression of environmental variables and axes scores. Since several environmental variables were determined to be significant and potentially autocorrelated, a Pearson correlation matrix was calculated. The autocorrelated variables were then removed and the resulting variables used to explain the distribution of sites along the two major axes of the scatterplot. These environmental gradients are shown by replacing site codes with values for each parameter in the DCA scatterplot.

Table 1. Sample sites removed from statistical analyses of 1992 macroinvertebrate data.

SITE CODE	SITE DESCRIPTION	RATIONALE
CAV1	Cave Creek nr Mt. Wrightson	Intermittent stream
CHV4	Chevelon Canyon at Chevelon Crossing	Impacted stream; stagnant murky water, algae bloom, campground, vehicles in road, grazing and logging in watershed
ECL2	E.Clear Creek abv Macks Crossing	Impacted stream; heavier algal growth than ECL1, housing developments and logging in watershed, dense thickets willow, alder and grasses and shrubs, no crayfish, lots of fish
EVD3	E.Verde River abv Brushy Canyon	Impacted site; siltation, large development upstream, recreation, grazing impacts
GAR1	Gardner Creek nr Mt. Wrightson	Intermittent stream; lack of fauna from scouring, grass in water, recreation & grazing
GOU1	Goudy Creek blw Goudy Spring	Impacted and intermittent; heavy grazing, high cowpie density
GRE1	Greenback Creek abv Devils Cyn	Impacted stream; grazing evident, heavy algal growth
HAS1	Hassayampa River nr Board Cr.confluence	Impacted site; mining, grazing and recreation use locally
LCR2	Little Colorado River blw South Fork	Impacted; grazing in & around stream, sedimentation
LCR3	Little Colorado River blw Nutrioso confluence	Impacted; sedimentation, heavy algal growth, grazing heavy upstream, WWTP Springerville, upstream dam
LCR9	Little Colorado River abv mouth at Colorado R.	Impacted; Large river, CaCO3 deposits, heavy silt
LIO1	Lion Cyn abv Weaver Creek confluence	Different waterbody, wetland-like, dissimilar habitat to nearby reference sites
POL1	Poland Creek blw Danny's lower spring	Impacted site; not much riffle, mining and grazing impacts
SFR1	San Francisco River blw Luna Lake	Different waterbody; Large river
		GRAND CANYON SITES
HAV1	Havasu Creek nr mouth	Impacted site; heavy recreation, livestock, septic, and development Supai village
MAT1	Matkatamiba Creek nr mouth	Impacted site; silted pools, flash flood impacts, heavy recreation
PAR1	Paria River nr mouth	Impacted site; heavy silt, grazing and recreation

Table 2. Thirteen environmental variables selected for regression and correlation analyses.

Environmental variable	Rationale for selection
Alkalinity, total	Reflects bicarbonate concentration needed for plant growth and habitat for bugs, high concentrations can indicate calcification of substrates and potential reduction of habitat
Dissolved oxygen	Needed for respiration, generally in high concentration at reference sites, except in areas of hyporheic contribution
Elevation	Broad scale factor which determines many other environmental parameters
Gradient	Local gradient explains water velocity and power at a site and contributes to habitat variety
Hardness	Reflects concentrations of calcium and magnesium at a site, micronutrients for plant growth at low concentration and can potentially change habitat conditions at high concentration
Habitat score, total	Reflects variety of instream habitat and erosion potential from bank and riparian vegetation alteration
pH	Factor affecting all potential chemical interactions
Pool/riffle ratio	Indicates habitat variety
Relief	Watershed scale factor indicating stream power and erosion/disturbance potential at a site
Total dissolved solids	Sum of ionic constituents in water
Temperature	Life cycles of macroinvertebrates keyed into annual variations in temperature
Turbidity	Reflects amount of particulate matter in water column, available as a food source or as disturbance variable
Watershed area	Reflects stream order and erosion/disturbance potential at a site

A cluster analysis using SYSTAT software (Wilkinson and Hill, 1994) was then performed to identify the natural grouping structure of the macroinvertebrate communities based upon the empirical data. The purpose of the cluster analysis was to place objects into groups suggested by the data, rather than defined *a priori*. Objects in a given cluster tend to be similar to each other and dissimilar with objects in a different cluster. Three different linkage methods using squared euclidean distances were tried; average linkage, complete linkage and Ward's minimum variance linkage method. The clusters produced by the three cluster runs were compared. The average linkage method was selected because it clustered sites most similarly to the other two cluster methods. The cluster regions defined by reference site classification in the cluster analysis were then overlaid onto a map of ecoregions of the state (using Arcview2 software) for a visual comparison of ecoregions and clusters. A statistical summary of physico-chemical parameters for each cluster was calculated using QuattroPro spreadsheets and included descriptive statistics such as minimum, maximum, mean values, and standard deviation.

Thirteen metrics, parameters which measure a component of the macroinvertebrate community structure or function, were calculated. Seven of the Rapid Bioassessment Protocol metrics were calculated based on the genus level macroinvertebrate data (taxa richness, modified Hilsenhoff biotic index, ratio of scrapers/filterers, ratio of EPT/Chironomidae abundance, percent contribution of dominant taxa, EPT index, and the ratio of shredders to total abundance). Additional metrics such as percent Hydropsychidae abundance to total Trichoptera abundance (Barbour et al., 1992), percent Chironomidae to total Diptera, percent Tanytarsini to total Diptera (Ohio EPA, 1990), percent Simuliidae to total Diptera, percent Baetidae to total Ephemeroptera (Bahls et al., 1992), and the Shannon-Wiener diversity index (Smith, 1986) were also calculated. Altogether, these metrics may provide information about community structure and function which will produce an integrated assessment of ecological integrity.

The distribution of Ephemeroptera, Plecoptera and Trichoptera (EPT) indicator assemblages was examined using scatterplots from the DCA output. These graphs provide a visual image of the EPT associations with environmental gradients. The orders Ephemeroptera, Plecoptera and Trichoptera will be used interchangeably with the common names, mayflies, stoneflies, and caddisflies, respectively, throughout the remainder of this report.

Box and whisker plots of the 13 metrics by cluster and ecoregion were produced using SYSTAT. The box and whisker plot "notched" option was used. The notch in each boxplot defines the 95% confidence interval. Differences among and between clusters and ecoregions can be deemed significant if these notched areas do not overlap. A comparison of macroinvertebrate community structure could then be made on the basis of the amount of variance and the degree of difference between the metric medians and confidence intervals.

RESULTS AND DISCUSSION

A complete summary of all collected geographic, habitat, water quality, and macroinvertebrate data and metrics are presented in Appendices A-J. Portions of these data are referenced in the following discussion, though not all the data are discussed here.

Ecoregion definition

Aquatic biological communities vary depending on the physical and chemical characteristics of the aquatic environment, as influenced by the landscape. Even within individual stream basins there is a large amount of variance in macroinvertebrate community structure (e.g. the number of EPT taxa). In our attempts to define the best attainable reference community structure, a means of organizing streams in different areas of the state by region is necessary. Approaches for classifying streams have been studied by others including classification systems for streams based upon stream order (Vannote et al., 1980), climate and vegetation (Bailey, 1983), and multiple parameters such as soils, land use, landforms and vegetation (Omernik, 1987). The classification developed by Omernik has been applied by several states in developing regional reference sites for bioassessment work. Omernik's classification system has become known as the "ecoregion concept" and provides a basis to begin examining the distribution of macroinvertebrate communities in Arizona.

Because ecoregions are based upon broad scale landscape features, and because aquatic ecosystem structure tends to reflect the surrounding landscape, it seems appropriate that ecoregions might provide a good framework for defining aquatic macroinvertebrate communities. Ecoregions have been tested for accuracy in other parts of the country, such as Ohio (Hughes and Larsen, 1988), where the landscape within regions is relatively homogenous and transition zones are minimal. However, Arizona geography is not homogeneous. For example, there are "sky-island" mountains (Heald, 1951) in desert areas in which all the life zones from desert to spruce-fir forest may lie in close proximity to one another as you travel from the base to the top of these mountains along an elevation gradient. Transition zones between desert and montane uplands also have great variation in elevation and life zones. Because Arizona topography is different and because initial surveys of macroinvertebrate communities indicated a wide range of fauna within ecoregions, the ecoregion concept is being evaluated before being applied as a framework for defining regional reference conditions. That is, are ecoregions, as currently structured, a correct and accurate basis for regional comparisons of the biological community structure of aquatic ecosystems?

There are 5 ecoregions in the state as defined by Omernik (1987) shown in Figure 1: Southern Basin and Range (SBR), Southern Deserts (SD), Arizona-New Mexico Mountains (AZNMM), Arizona-New Mexico Plateau (AZNMP) and the Colorado Plateau (CP). The majority of sampled reference sites are in the former three ecoregions where most of the perennial water of the state lies. A brief description of each ecoregion is presented in Table 3. These ecoregions are contiguous areas on the map and generally appear to follow familiar vegetation distribution patterns of the Sonoran Desert, Chihuahuan Desert, Great Basin Desert and montane forested uplands. However a problem with these ecoregions is evident when examining Table 3.

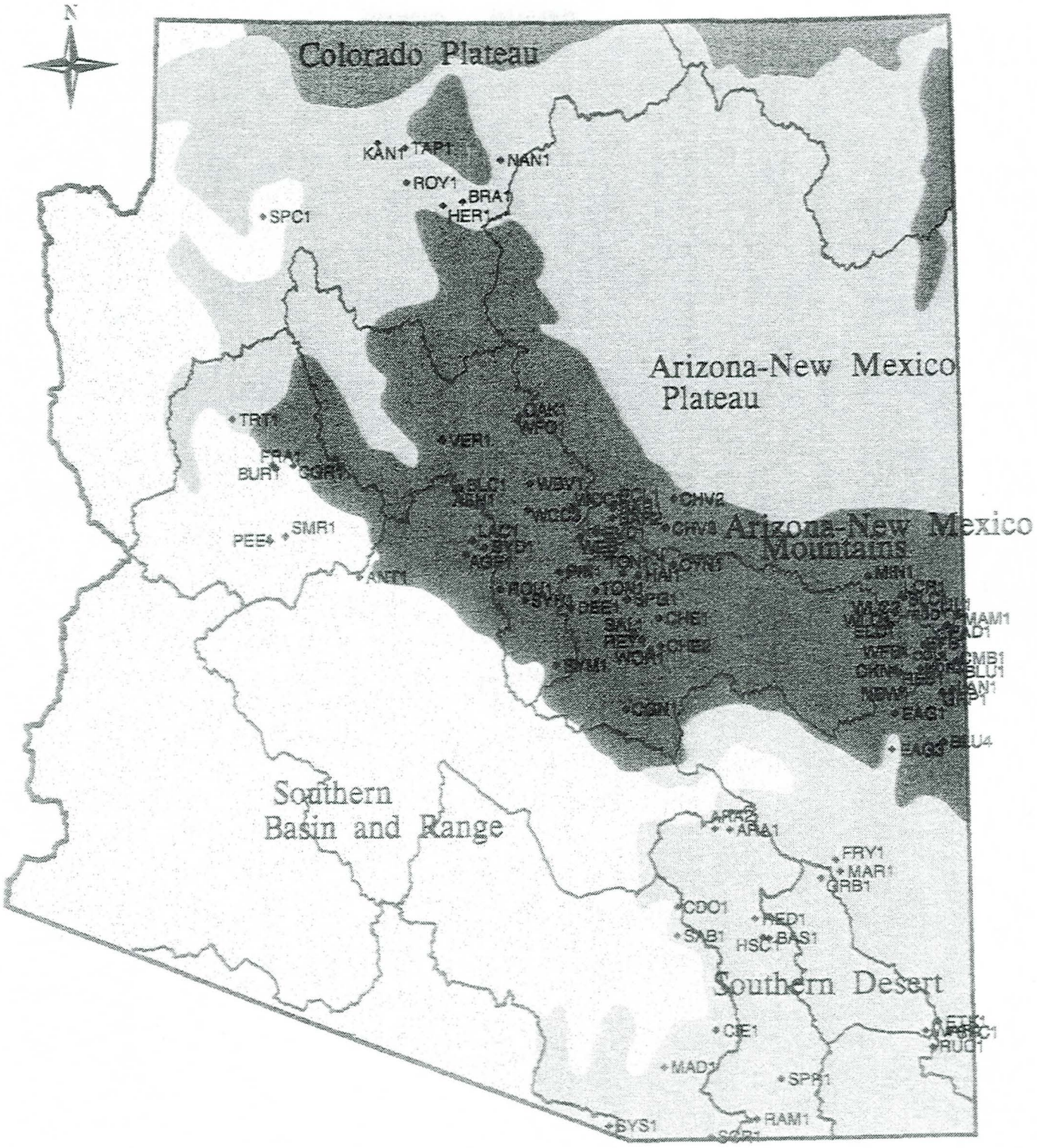


Figure 1. Reference biological monitoring sites in 108 Arizona streams sampled in 1992.

Table 3. Characteristics of ecoregions in Arizona (Omernik, 1987).

Ecoregion	Land Surface Form	Potential Natural Vegetation	Land Use	Soils
Arizona/New Mexico Mountains (AZNMM)	Low to high mountains	Pine/Douglas-fir, Juniper/Pinyon woodland, southwestern spruce/fir, Arizona pine	Forest and woodland grazed, open woodland grazed	Dry Aridisols, dry Mollisols
Arizona/New Mexico Plateau (AZNMP)	Tablelands with considerable to very high relief, plains with low mountains	Grama/Galleta steppe, Great Basin sagebrush, Saltbush/greasewood	Subhumid grassland and semiarid grazing land, desert shrubland grazed	Aridisols, Entisols
Colorado Plateau (CP)	Tablelands with considerable to very high relief, plains with high mountains	Saltbush/greasewood, blackbush, juniper/pinyon woodland, Great Basin sagebrush	Open woodland grazed, desert shrubland grazed, some irrigated agriculture	Light-colored soils of arid regions, immature shallow soils on consolidated upland materials
Southern Basin and Range (SBR)	Plains with low mountains	Creosote, Creosote/Bursage, Palo Verde/cactus shrub	Desert shrubland grazed, some irrigated agriculture	Aridisols
Southern Deserts (SD)	Plains with high hills to high mountains, open high mountains	Grama/tobosa shrub-steppe, Trans-Pecos shrub savanna (tarbush, creosote)	Desert shrubland grazed	Aridisols, rock outcrops

The varying degrees of relief found within the ecoregions, especially the Arizona/New Mexico Mountains and Southern Deserts ecoregions, indicates that the landforms are not homogenous. In addition, the potential natural vegetation of the AZNMM ecoregion ranges widely from pinyon/juniper woodlands to subalpine spruce/fir forests and the vegetation of the SD ecoregion varies from desertscrub and grassland to montane coniferous forests (Brown, 1994). The great amount of variance in vegetation type reflects the varied topography and relief of the mountains found within these ecoregions.

The ecoregion map may oversimplify the life zone distribution in Arizona. This is easily seen when comparing the ecoregions map (Omernik, 1987) with the Biotic Communities of the Southwest map (Brown, 1994). The Biotic Communities of the Southwest map reveals the complexity of defining homogenous ecoregions in Arizona by showing the rapid change in life zones with increases in elevation in "sky island" areas of the Southern Deserts ecoregion and along the Mogollon Rim area of the Arizona/New Mexico Mountains ecoregion.

Multivariate Analysis of Ecoregions

A Detrended Correspondence Analysis (DCA) of macroinvertebrate community structure was performed to test the applicability of the ecoregion concept to aquatic ecosystems in Arizona. Three DCA plots are presented which display the macroinvertebrate distribution at sites, basins and ecoregions (Figures 2-4). In the first plot (Figure 2), sites having similar macroinvertebrate communities are grouped closely together, whereas dissimilar sites or groups of sites are shown by their separation along the gradients of axis 1 and 2.

In the second plot (Figure 3), the site codes were re-labelled with basin codes to determine the similarity of macroinvertebrate communities within basins. Sites within the Bill Williams Basin grouped together well, as did sites within the Northern Colorado River Basin. However, sites within the San Pedro River Basin were separated into two distinct clusters, as shown in Figure 3. The Upper Gila River Basin also displayed this distribution. Sites within the Verde, Middle Salt, Middle Gila, and Santa Cruz formed very large diffuse clusters indicating greater dissimilarity in macroinvertebrate community structure in these basins than in other basins. Sites within the Little Colorado River Basin and sites within the Upper Salt River Basin were spread out widely along axis 1 indicating that considerable variation exists among macroinvertebrate communities of sites in these basins. This scatterplot of sites by basin indicates that basins are not an appropriate statewide regionalizing model for macroinvertebrate communities.

In the third plot (Figure 4), the site distribution graph was again re-labelled, this time with ecoregion codes to determine the similarity of macroinvertebrate communities within ecoregions. The most tightly clustered group of sites was within the Southern Basin and Range ecoregion. The other three ecoregions encompass a large amount of variation along both axis 1 and 2. Sites within the Southern Deserts ecoregion were grouped into 2 clusters as circled in Figure 4, appearing to represent upland sites in one and lowland sites in the other cluster. Sites within the Arizona/New Mexico Plateau ecoregion were loosely clustered. Sites within the Arizona/New Mexico Mountains ecoregion were the most widely distributed along both axes 1 and 2 and overlap the clusters of the other ecoregions. The overlap and wide distribution of sites within the Southern Deserts and Arizona/New Mexico Mountains ecoregions provides evidence that these ecoregions, as currently defined, are too broad to be useful for classifying macroinvertebrates.

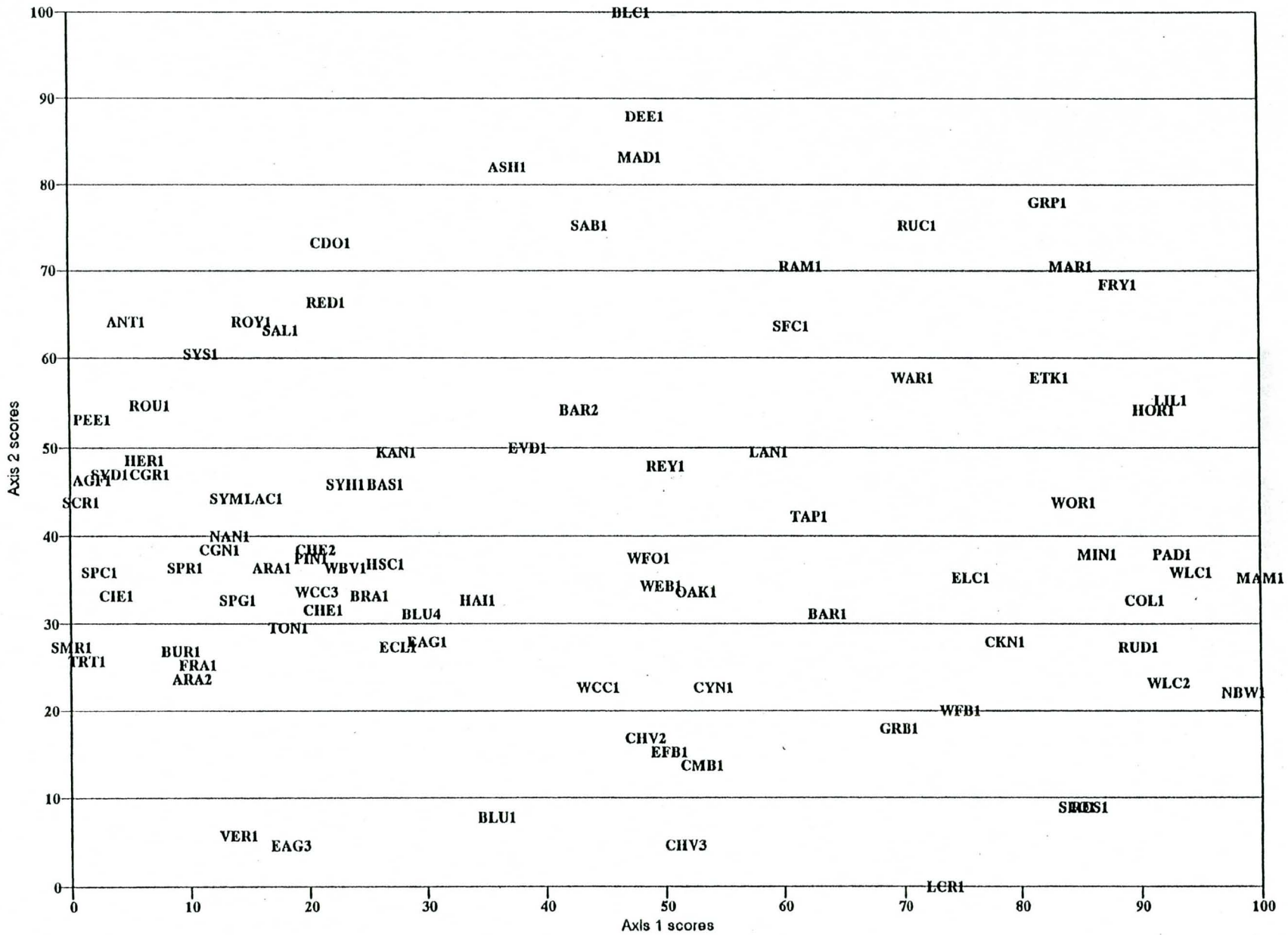


Figure 2. Results of Detrended Correspondence Analysis (DCA) of 1992 macroinvertebrate abundance at reference sites. Site distribution is represented by site codes. Appendix A lists the corresponding location for each site code.

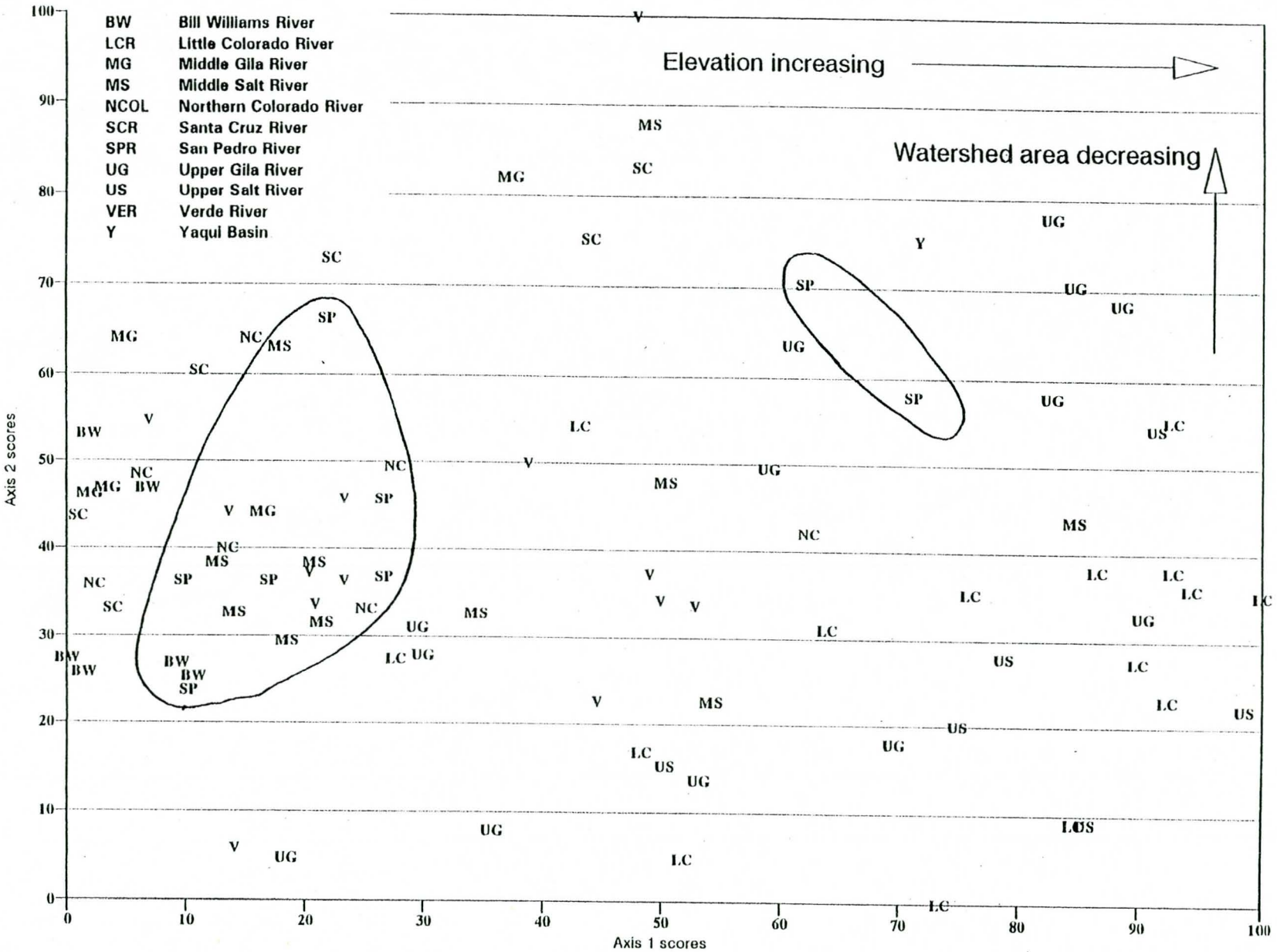


Figure 3. Results of DCA for 1992 macroinvertebrate abundances at reference sites. Site distribution is represented by surface water basin codes.

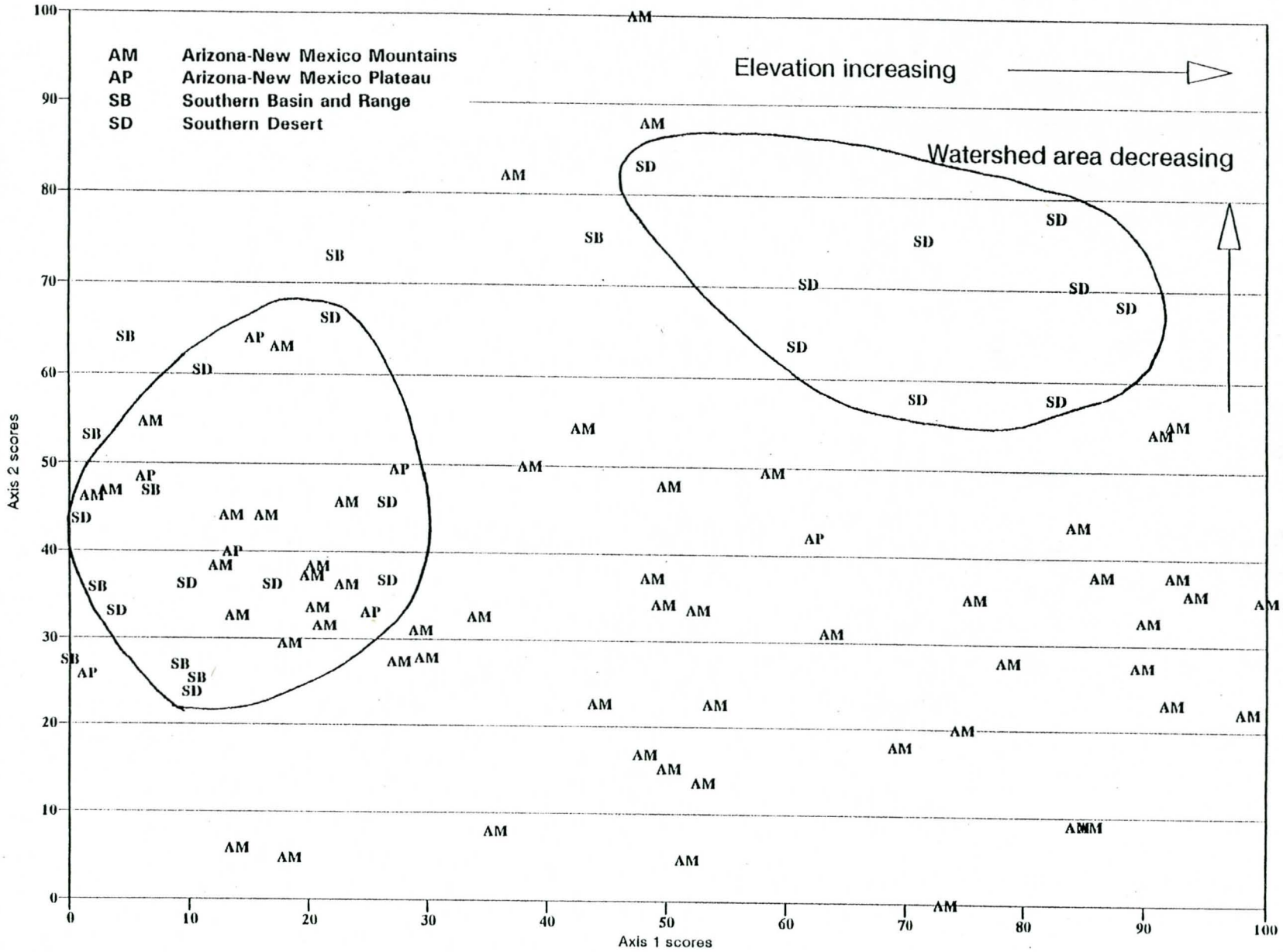


Figure 4. Results of DCA for 1992 macroinvertebrate abundance at reference sites. Site distribution is represented by ecoregion codes. Circled areas indicate two groups of sites within the Southern Deserts ecoregion.

Identification of Important Environmental Variables

If ecoregions are too broadly defined, then what classification system is more representative of the aquatic biota and what are the most important physical/chemical variables? To identify the most important environmental variables, multiple stepwise regression of the environmental variables on the DCA axes scores was performed. The partial correlations were then used to identify which environmental variable was most correlated with axes 1 and 2 of the DCA scatterplot.

Partial correlations were calculated for the thirteen selected environmental variables. Four variables were highly correlated ($p<0.001$) with the DCA axis 1 scores; elevation ($r=0.458$), temperature ($r=-0.469$), relief (0.233) and total dissolved solids ($r=-0.311$). Elevation was deemed to be the most important variable explaining site distribution along axis 1. This was because relief (0.370), TDS (-0.693), and temperature (-0.604) were highly autocorrelated with elevation, as determined by a Pearson correlation matrix of environmental variables. By deduction, elevation is the most important environmental variable explaining site distribution along axis 1 in Figures 2-4 and explains 21% of the among-site variance. Figure 5 shows the trend of increasing elevation along axis 1 towards the right of the scatterplot.

Two environmental variables were highly correlated ($p<0.001$) with axis 2 scores; watershed area (-0.486) and elevation (-0.335). Watershed area was selected as the variable best explaining site distribution along axis 2 because the partial correlation for watershed area was greater. Watershed area accounted for 24% of the variance along axis 2. Figure 6 shows the tendency of the data along axis 2 toward increasing watershed size at the lower left of the scatterplot. There may be some erratic data points on the graph due to the 2-dimensional nature of a multidimensional graph. In summary, the distribution of sites in Figures 2, 3, and 4 occurs along two major environmental gradients, elevation along the axis 1 and watershed area along the axis 2. Figures 5 and 6 present the values of these two variables and show the direction of increasing values along each axis.

Towards an Alternate Classification System

Though the previous analyses indicate correlations among sites, basins, and ecoregions with certain environmental parameters, they do not provide a new classification to compare with ecoregions. A cluster analysis was performed for this task. The cluster procedure joins sites together based upon the presence and abundance of species at each site. Sites are joined together successively based upon the similarity of the macroinvertebrate assemblages until all sites are joined into one major cluster. The number of significant clusters was determined by looking for breakpoints in the output of the program and by best professional judgement.

The cluster analysis was performed using the same data matrix of 91 sites and 309 taxa that was used for the DCA and regression analyses. In this analysis, the dataset separated into three major clusters according to the average linkage dendrogram (Figure 7). The list of sites in each cluster, listed alphabetically by basin is provided in Table 4. This classification scheme generally separates sites into three groups: 1) a group of high elevation montane streams, 2) a group of low elevation desert streams, and 3) a large group of sites in the transition zone between lowland and upland sites. It is important to note that each cluster incorporates sites from different basins and ecoregions.

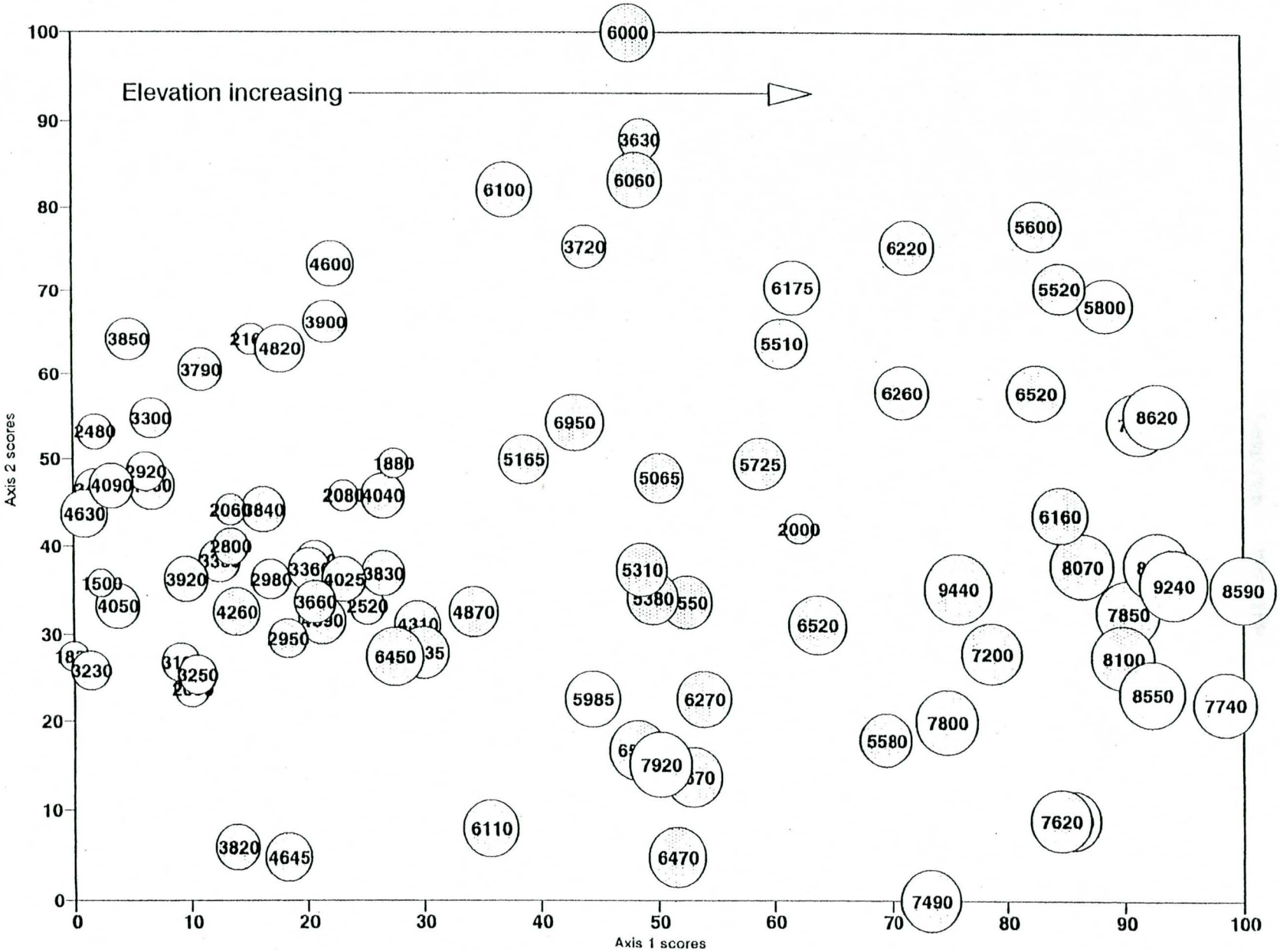


Figure 5. Results of DCA of 1992 macroinvertebrate abundance at Arizona reference sites showing the correlation between elevation and axis 1 scores ($R=0.458$, $p<0.001$). Relative size of circle reflects elevation (in feet).

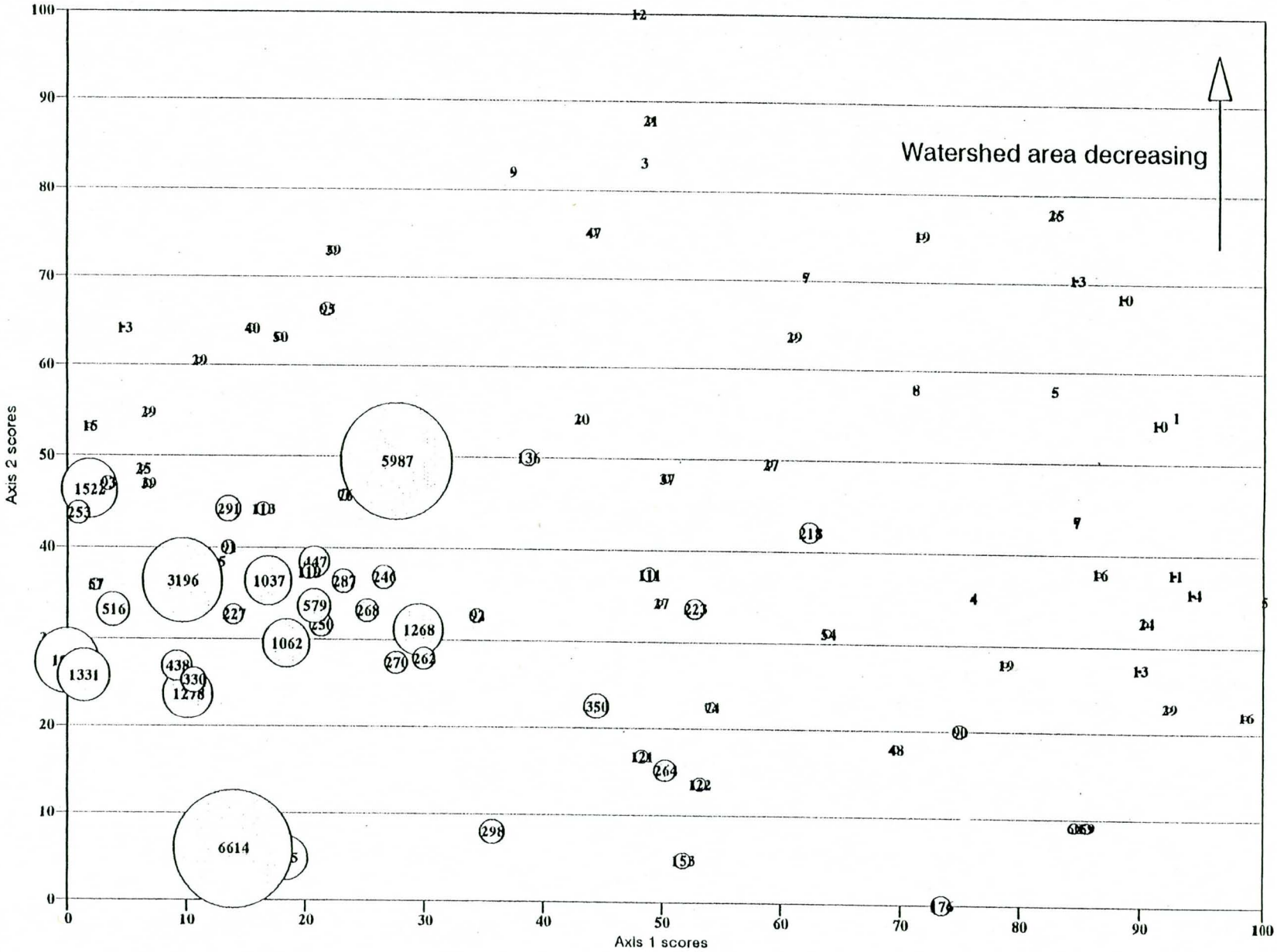


Figure 6. Results of DCA of 1992 macroinvertebrate abundance at Arizona reference sites showing the correlation between watershed area and axis 2 scores ($R=0.486$, $p<0.001$). Relative size of circle reflects watershed areas (in square kilometers).

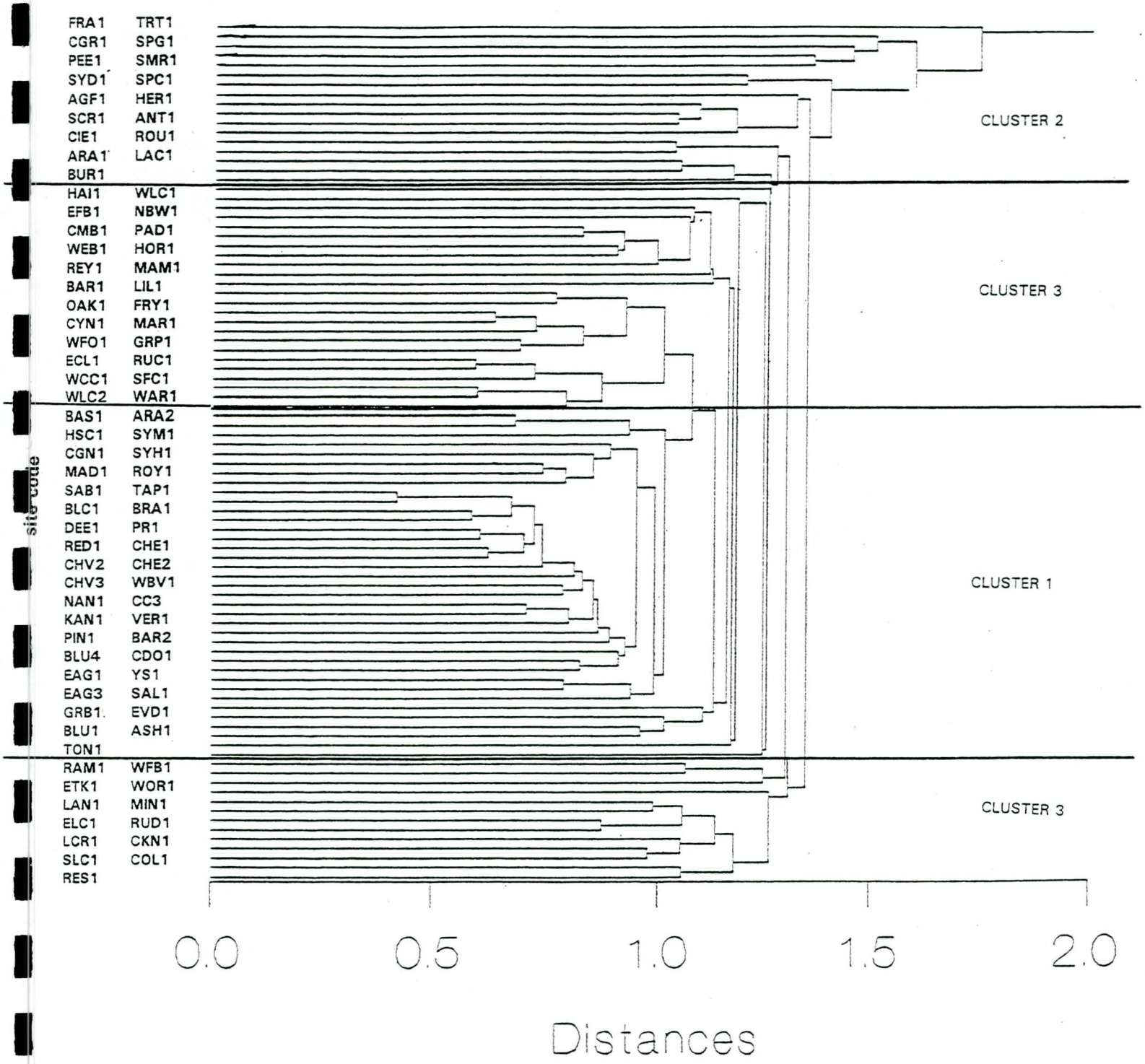


Figure 7. Cluster dendrogram results from average linkage cluster analysis of 309 macroinvertebrate taxa at 91 reference sites sampled in 1992.

Table 4. Cluster analysis results: site list for each cluster, sorted by basin, with ecoregions listed. (See Appendix A for stream names corresponding with site codes listed here. Basin Codes are as follows: BW, Bill Williams River; LCR, Little Colorado River; MG, Middle Gila River; MS, Middle Salt River; SCR, Santa Cruz River; SON, Sonora Basin; SPR, San Pedro River; UG, Upper Gila River; US, Upper Salt River; VER, Verde River; YAQ, Yaqui Basin. Ecoregion Codes are as follows: AZNMM, Arizona/New Mexico Mountains; AZNMP, Arizona/New Mexico Plateau; SBR, Southern Basin & Range; SD, Southern Deserts).

CLUSTER1			CLUSTER 2			CLUSTER 3		
Site Code	Basin	Eco-region	Site Code	Basin	Eco-region	Site Code	Basin	Eco-region
ARA2	SPR	SD	AGF1	MG	AZNMM	BAR1	LCR	AZNMM
ASH1	MG	AZNMM	ANT1	MG	SBR	CKN1	US	AZNMM
BAR2	LCR	AZNMM	ARA1	SPR	SD	CMB1	UG	AZNMM
BAS1	SPR	SD	BUR1	BW	SBR	COL1	UG	AZNMM
BLC1	VER	AZNMM	CGR1	BW	SBR	CYN1	MS	AZNMM
BLU1	UG	AZNMM	CIE1	SCR	SD	ECL1	LCR	AZNMM
BLU4	UG	AZNMM	FRA1	BW	SBR	EFB1	US	AZNMM
BRA1	NC	AZNMP	HER1	NC	AZNMP	ELC1	LCR	AZNMM
CDO1	SCR	SBR	LAC1	MG	AZNMM	ETK1	UG	SD
CGN1	MS	AZNMM	PEE1	BW	SBR	FRY1	UG	SD
CHE1	MS	AZNMM	ROU1	VER	AZNMM	GRP1	UG	SD
CHE2	MS	AZNMM	SCR1	SCR	SD	HOR1	US	AZNMM
CHV2	LCR	AZNMM	SMR1	BW	SBR	LAN1	UG	AZNMM
CHV3	LCR	AZNMM	SPC1	NC	AZNMP	LCR1	LCR	AZNMM
DEE1	MS	AZNMM	SPG1	MS	AZNMM	LIL1	LCR	AZNMM
EAG1	UG	AZNMM	SYD1	MG	AZNMM	MAM1	LCR	AZNMM
EAG3	UG	AZNMM	TRT1	BW	AZNMP	MAR1	UG	SD
EVD1	VER	AZNMM				MIN1	LCR	AZNMM
GRB1	UG	AZNMM				NBW1	US	AZNMM
HAI1	MS	AZNMM				OAK1	VER	AZNMM
HSC1	SPR	SD				PAD1	LCR	AZNMM
KAN1	NC	AZNMP				RAM1	SPR	SD
MAD1	SCR	SD				RES1	US	AZNMM
NAN1	NC	AZNMP				REY1	MS	AZNMM
PIN1	VER	AZNMM				RUC1	YAQ	SD
RED1	SPR	SD				RUD1	LCR	AZNMM
ROY1	NC	AZNMP				SFC1	UG	SD
SAB1	SCR	SBR				SLC1	LCR	AZNMM
SAL1	MS	AZNMM				WAR1	SPR	SD
SPR1	SPR	SD				WCC1	VER	AZNMM
SYH1	VER	AZNMM				WEB1	VER	AZNMM
SYM1	VER	AZNMM				WFB1	US	AZNMM
SYS1	SON	SD				WFO1	VER	AZNMM
TAP1	NC	AZNMP				WLC1	LCR	AZNMM
TON1	MS	AZNMM				WLC2	LCR	AZNMM
VER1	VER	AZNMM				WOR1	MS	AZNMM
WBV1	VER	AZNMM						
WCC3	VER	AZNMM						

Physical Characteristics of Clusters

The physical characteristics of sites in the three clusters are summarized in Appendix G. Cluster 3 sites can best be described as montane streams generally having the highest mean elevation, highest mean gradient, smallest watershed area, coldest temperature, lowest alkalinity, and highest mean habitat score. Cluster 2 sites can be described as belonging to desert lowland streams, generally having lowest mean elevation, low gradient, highest mean temperature, highest alkalinity and lowest mean habitat score. Cluster 1 sites can be termed transition zone streams because they are described by intermediate values of most physical parameters and by having large ranges and standard deviations for several parameters, including elevation, watershed area, alkalinity, and TDS. The bar graph in Figure 8 displays these differences among the three clusters for important physical parameters. Clusters 1, 2 and 3 will hereafter be referred to as transition zone streams, desert lowland streams, and montane streams, respectively.

Macroinvertebrate Characteristics of Clusters

The macroinvertebrate characteristics of each cluster are summarized in two ways: with mean metric values and box and whisker plots. Summary metrics as well as percent composition of the macroinvertebrate community by orders are calculated for each site are presented in Appendices H and I and box and whisker plots are presented in Appendix J. The thirteen metrics were initially selected to provide a broad range of information about the structure and function of the macroinvertebrate community. These are preliminary metrics used in this paper for exploratory purposes. Other metrics may be utilized in future analyses and each metric will be tested for appropriateness to Arizona ecosystems and for accuracy in detecting different levels of impairment.

Distinct differences in metric values between the clusters are evident. The lowland desert streams are described as having high community richness, the greatest EPT/chironomidae ratio, the greatest HBI index, and the lowest dominance by the top five dominant species. Key community characteristics of montane upland sites include greatest EPT richness, lowest HBI scores, greatest percent composition by shredders, greatest ratio of scrapers/collector-filterers, and the lowest percent composition of Hydropsychidae/total Trichoptera and Baetidae/total Ephemeroptera. Transition zone sites are described by having lowest EPT richness, lowest EPT/Chironomidae ratios, greatest percent composition of Baetidae/Ephemeroptera, and greatest percent composition by Chironomidae. The implication of these metric comparisons is that the structural and functional characteristics of the macroinvertebrates are very different for desert streams than for montane streams and the regional reference condition that will be developed for standards and assessment purposes should reflect this.

Important EPT Taxa for Each Cluster

Since the EPT taxa are generally considered the most sensitive to pollution, they may be used as indicators of good water quality. And since the clusters are based in part on the distribution and abundance of EPT taxa, it should be possible to define an indicator EPT assemblage for each cluster. In order to show their relative importance in defining the clusters, each of the EPT orders were plotted along the environmental gradients of elevation and watershed area in the species scatterplot output from the DCA analysis. These scatterplots show the distribution of the Ephemeroptera, Plecoptera and Trichoptera

taxa in relation to elevation and watershed area gradients and in relation to site distributions (Figures 9, 10, and 11).

Stoneflies, or Plecoptera, are generally found only in montane cold water streams. The data confirm that the cold water shredder and predatory species of stoneflies were commonly found in the high elevation, cold water streams of cluster 3, were sometimes occurring in cluster 1 transition zone streams and were not found in most streams of the cluster 2 desert lowlands. Figure 9 shows that the stonefly assemblage of high elevation, cold water streams consisted of the taxa *Amphinemura*, *Hesperoperla*, *Isoperla*, Chloroperlidae and Perlodinae. *Amphinemura* was the most widely distributed taxa in cluster 3 and cluster 1 streams. The stoneflies Chloroperlidae and *Isoperla* were also commonly found in cluster 3 streams. Taxa of the families Taeniopterygidae and Capniidae were generally found at moderate elevation cluster 1 transition zone sites having high relief and with small watershed areas. However, Capniidae are considered winter stoneflies and complete their life cycle earlier in the year than other taxa and may not be well represented because of the time of sampling. As a result, Capniidae may actually occur at many more transition zone sites or higher elevation sites than were found during 1992. Taeniopterygidae were also commonly found in transition zone streams; these are also winter stoneflies and it is not known whether their distribution is adequately represented by the 1992 data.

The mayflies Baetidae, *Caenis, Choroterpes/Thraulodes*, other Leptophlebiidae larvae and *Tricorythodes* were common to upland, transition, and lowland streams, as shown by the central location of these species codes in the Figure 10 DCA plot. However, several dominant mayfly taxa, clustered at right in the scatterplot, distinguished the montane mayfly association from the mayflies of the transition and lowland streams. The dominant montane mayflies included *Ameletus, Cinygmula, Epeorus, Heptagenia/Nixe*, and *Paraleptophlebia*. Two species of *Drunella* were rare and exclusively found in high elevation streams. Mayflies that were more common to transition and desert streams included *Baetodes* and *Leptohyphes*. Several taxa that were unique to transition zone streams included *Isonychia, Rhithrogena, Serratella* and *Traverella*, occurring at the lower elevation streams with large watersheds, shown at lower left in Figure 10. Mayflies of the desert lowland streams are remarkable in their lack of "indicator" taxa and because the dominant taxa in these streams are the ubiquitous mayflies found statewide at all reference sites.

Many more caddisflies were unique to the montane cluster, whereas caddisflies of the transition and desert streams consisted primarily of ubiquitous taxa. The montane assemblage consisted of many taxa unique to this cluster at the far right in the Figure 11 DCA plot. These 16 taxa are found in streams having high elevation, high relief and small watershed areas and include taxa of the families Brachycentridae, Glossosomatidae, Lepidostomatidae, and Limnephilidae. Caddisflies of the transition zone consisted of 14 ubiquitous taxa (center of Figure 11) including *Cheumatopsyche, Chimarra, Helicopsyche, Hydropsyche, Hydroptilidae, Ithytrichia, Marilia, Nectopsyche, Neotrichia, Ochrotrichia, Oecetis, Oxyethira, Polycentropus*, and *Tinodes*. A montane-transition zone group of taxa (right center in Figure 11) included *Glossosoma*, Hydroptilidae and Limnephilidae larvae, *Micrasema*, *Phylloicus, Oecetis*, and *Rhyacophila Coloradensis Group* larvae. A desert-transition zone group of taxa (left-center in Figure 11) included *Hydroptila, Leptonema, Leucotrichia, Mayatrichia, Wormaldia, and Zumatrichia*. There were no unique caddisflies for the desert lowland streams, rather they consisted of the ubiquitous taxa and those taxa common to both desert and transition zones. Two of the three taxa of the Hydropsychidae

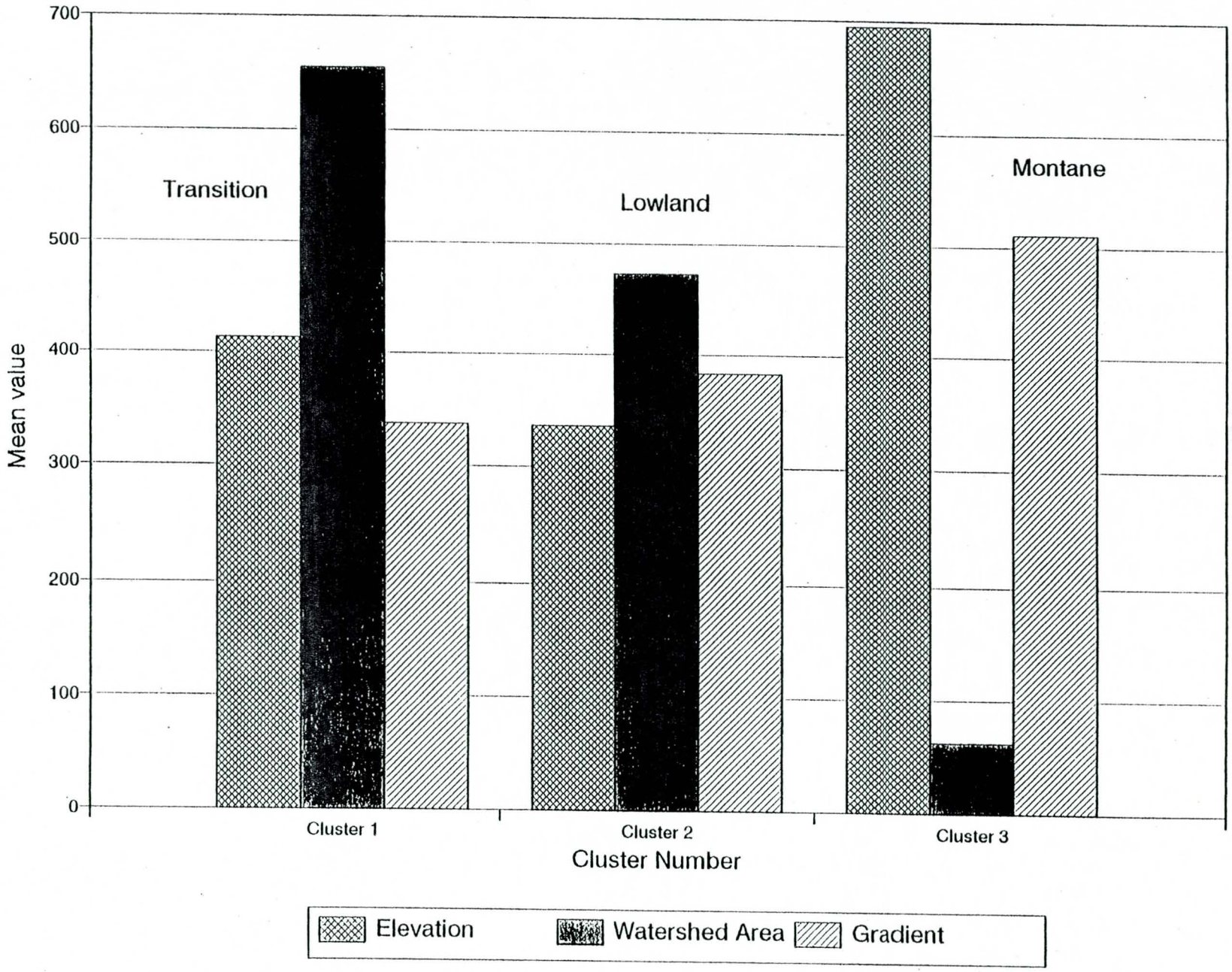


Figure 8. Mean physical parameter values of identified clusters at Arizona reference sites, 1992 (To achieve consistent a y-axis scale, values were modified by the following factors: Elevation/10, Gradient*10,000, Watershed area*1).

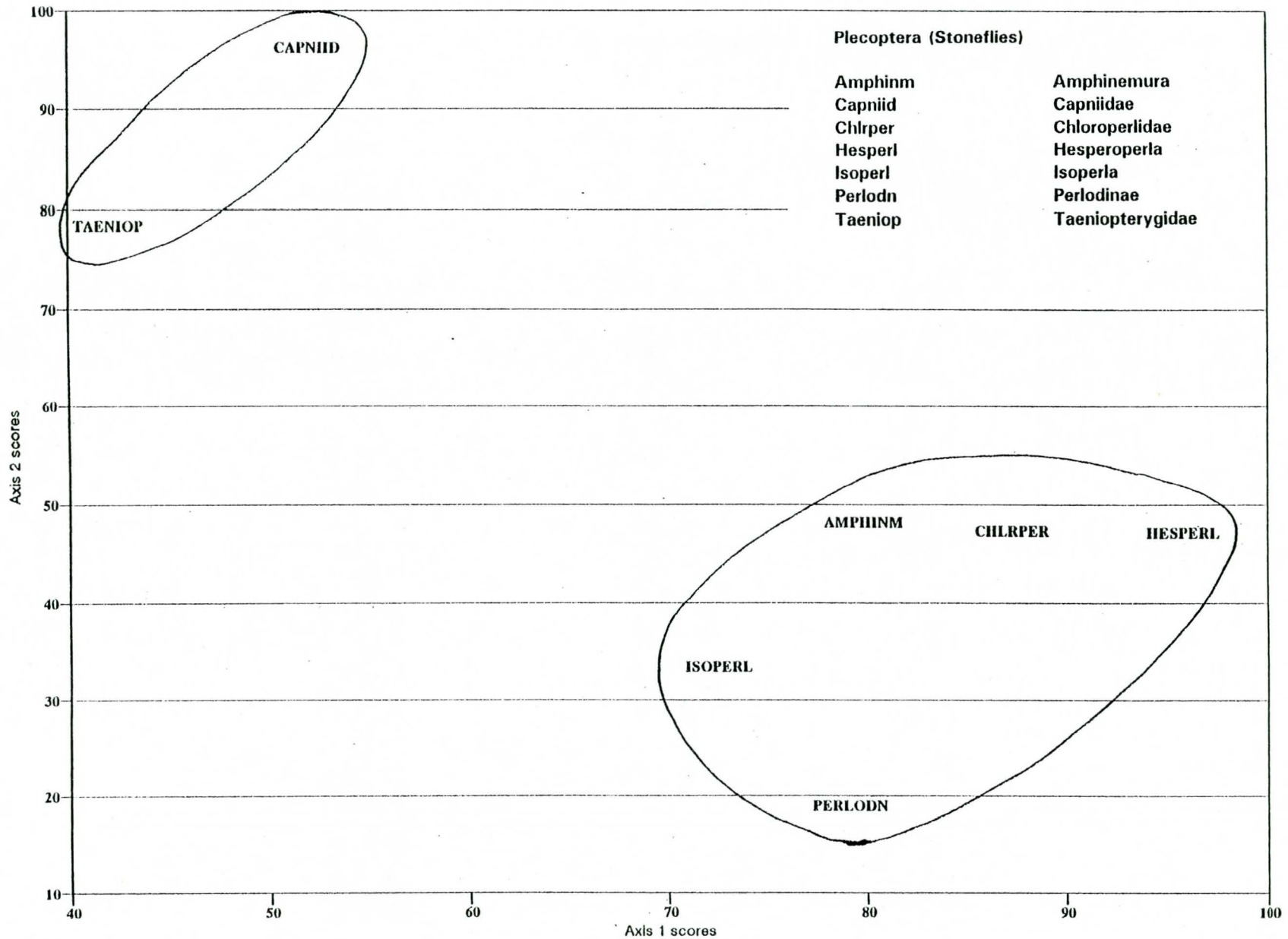


Figure 9. Results of DCA showing the distribution of Plecoptera (stonefly) taxa at 1992 Arizona reference sites with respect to environmental gradients.

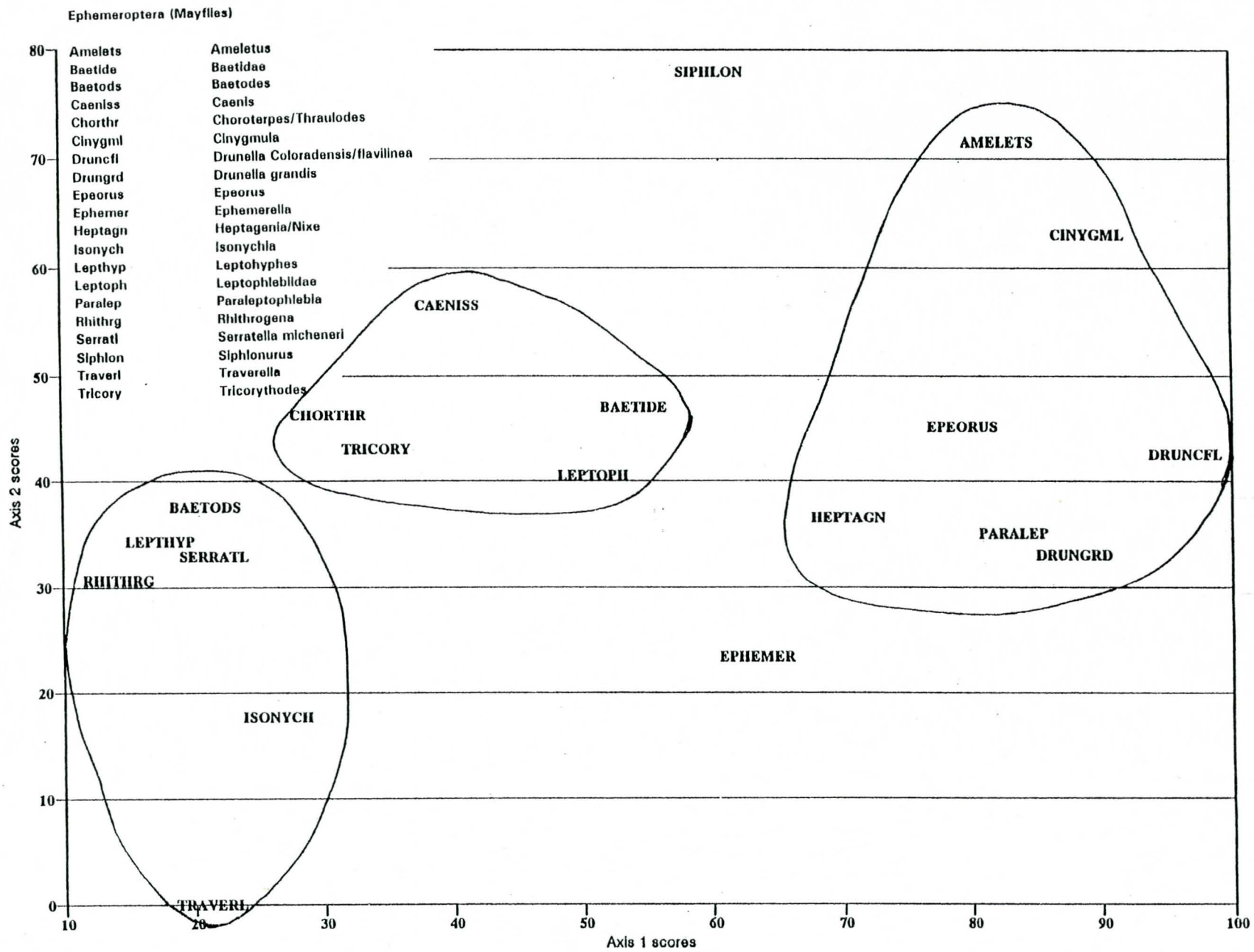


Figure 10. Results of DCA showing the distribution of Ephemeroptera (mayfly) taxa at 1992 Arizona reference sites with respect to environmental gradients

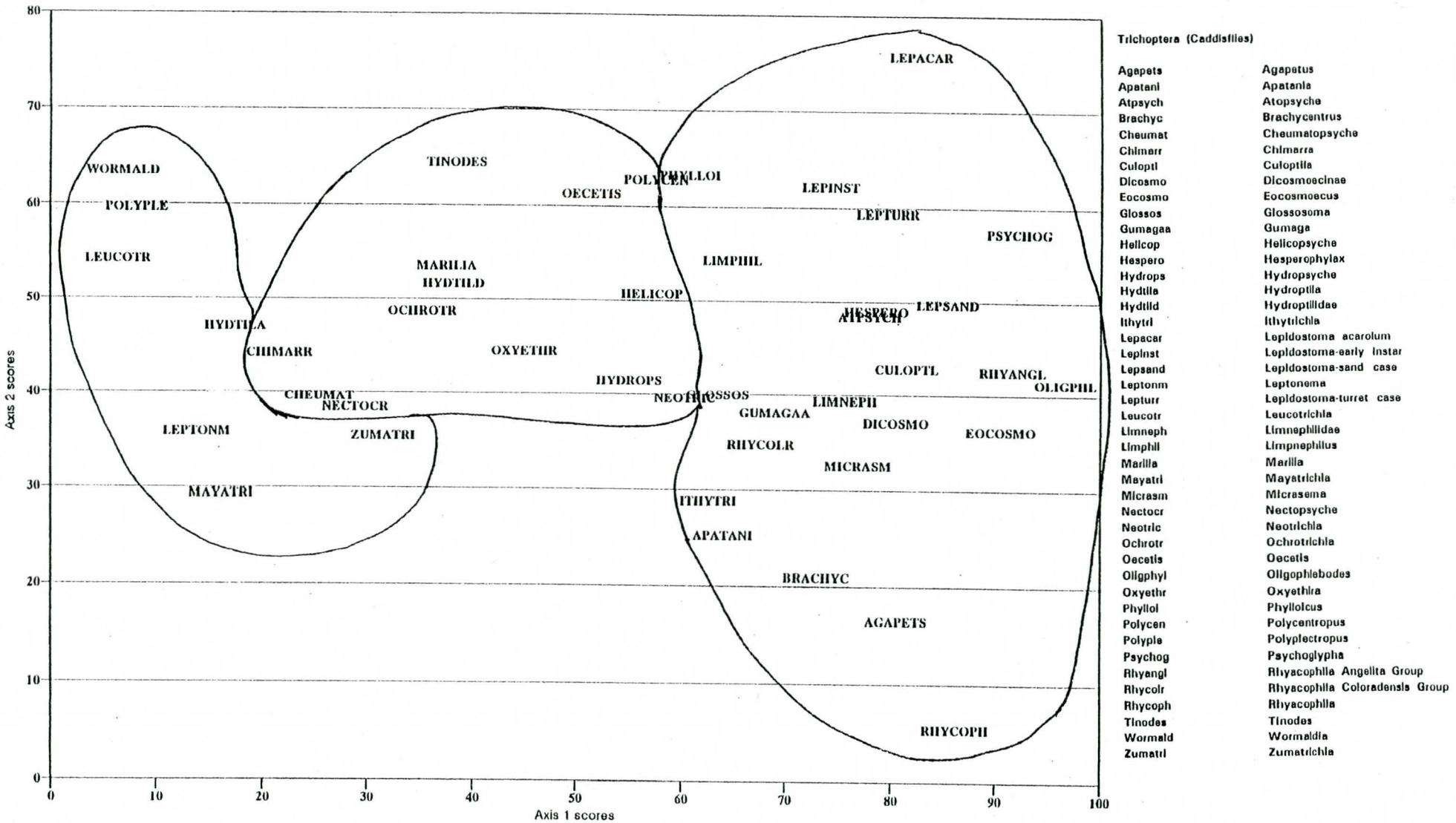


Figure 11. Results of DCA showing the distribution of Trichoptera (caddisfly) taxa at 1992 Arizona reference sites with respect to environmental gradients.

(*Cheumatopsyche* and *Leptonema*) were correlated with larger watershed areas and lower elevations. *Hydropsyche* was the most widespread caddisfly (n = 76) as indicated by it's central location on the scatterplot. The desert lowland assemblage appears to consist of caddisflies common to all Arizona streams except that they are simply more abundant in desert streams.

Cluster and Ecoregion Comparisons

The goal of the cluster analysis was to minimize variance in metric values within clusters and to minimize variance associated with ecoregions. To do this, metrics describing the macroinvertebrate community were compared between clusters and ecoregions using box and whisker plots. Boxplots provide for a comparison of the median values and 95% confidence intervals.

Metric Comparisons

Box and whisker plots of each metric which allow a comparison of the grouping effectiveness of clusters and ecoregions are presented in Appendix J. These plots provide a visual and statistical summary of the data by presenting the 25th, 50th (median), and 75th percentiles, outliers, and the notched area indicating the 95% confidence interval (Appendix J1).

In general, the separation of medians and 95% confidence interval notches was more distinct among clusters than among ecoregions, indicating that these clusters may better describe the distribution of the macroinvertebrate community than ecoregions. In addition, upon comparison of cluster 3 with the AZNMM ecoregion and cluster 2 with the SBR ecoregion, we find less variance within clusters than within ecoregions. These findings are most evident in the first five metric boxplots in Appendix J.

The box and whisker diagrams of percent Hydropsychidae/Total Trichoptera show distinct differences between clusters. In cluster 3 montane streams the ratio was distinctly different from the other two clusters, meaning that the Hydropsychidae made up a much lower percentage of the caddisflies than in the other two clusters. The median was similar between cluster 1 and 2 but the variance was much greater in transition zone streams of cluster 1 than in desert lowland streams of cluster 2. The ecoregions AZNMM and SBR showed a similar relationship to clusters 3 and 2, however the ecoregions displayed much greater variance than the clusters.

Clusters were well separated using the percent shredders to total abundance metric, but ecoregions were not as well separated. The median shredder abundance was high in cluster 3 sites, low in transition zone streams of cluster 1 and almost nonexistent in lowland desert streams of cluster 2. The median shredder abundances were not very different between AZNMM and SD ecoregions. This was expected because shredders are found where coarse particulate matter (e.g. leaf packs) is abundant, primarily in montane streams. One would not expect to find shredders in autotrophic desert streams in which the food source is dominated by algae instead of leaf packs and woody debris (Busch and Fisher, 1981).

The EPT richness metric distinguished well between cluster 2 and 3 as shown by the lack of overlap of the 95% confidence interval, though cluster 1 and 2 medians were not

different. Median EPT richness values were not well separated for ecoregions as shown by the overlapping 95% confidence interval notches. As expected, the EPT richness was greatest for the montane streams of cluster 3, and was much less for clusters 1 and 2. High EPT richness is expected for cluster 3 because stoneflies are typically limited to higher elevation cold water streams, and because there are several montane species of mayflies and caddisflies not found in lower elevation streams. The clusters distinguish between EPT richness at upland and lowland streams better than ecoregions for this metric.

The Hilsenhoff Biotic Index (HBI) provides information about the tolerance to organic pollution by organisms and communities; low scores indicate relative sensitivity and high scores indicate relative tolerance of organic pollution, in general. However it was expected that assemblages in different ecoregions would have varying HBI scores due to differences in natural habitat. Cluster HBI scores were distinctly different among the three clusters, as noted by the separation of 95% confidence interval notches, than among ecoregions AZNMM and SD for which notched areas were overlapping. Median values, however, were similar between cluster 3 and AZNMM and between cluster 2 and SBR. Reference sites in different regions displayed expected differences; montane macroinvertebrate assemblages had lower HBI scores indicating greater sensitivity to organic enrichment and desert lowland assemblages had higher HBI scores indicating greater tolerance to such disturbance. These observations make sense because desert streams, having large autochthonous inputs, may naturally be more prone to year-round organic inputs than cold montane streams, having seasonal allochthonous inputs. More work needs to be done to determine what the range of HBI scores for desert streams will be; most of the previous work with HBI scores has been in more temperate regions of the country.

The total richness metric does not distinguish well between either clusters or ecoregions; the median values range between 50 and 60 for clusters and 30 to 55 for ecoregions. The median richness was very similar for the desert lowland streams was similar to and only slightly less than the median richness for the montane highland streams. The median richness of the transition zone streams of cluster 1 was about 5 taxa less than the other two clusters. Median richness among ecoregions was the same for three of the ecoregions but was much lower for the Colorado River sites of the AZNMP ecoregion.

Differences between clusters and ecoregions were not found when using several other metrics. Several of these metrics are ratios (e.g. EPT/Chironomidae abundance) which have been found to be less useful than other metrics such as percent Hydropsychidae/Total Trichoptera abundance (Barbour, et al. 1992). The lack of clear separation of clusters and ecoregions using these metrics may also be an indication that these metrics may not be appropriate for use in Arizona. Further work needs to be done to assess the accuracy of each metric for use in Arizona.

EPT Comparisons

Another way to compare ecoregions and clusters is to look at the distribution of key taxa. An example taxon of each of the EPT orders was selected to show how the distribution of key taxa shape the clusters and to show the differences between clusters and ecoregions (Figure 12). The distribution of the stonefly *Amphinemura* shows its absence from both cluster 2 and the SBR ecoregions, but the agreement between clusters and ecoregions ends there. The median abundance of *Amphinemura* in cluster 1 and 3 are very

different but the median abundance between the AZNMM and SD ecoregions is very similar. The median abundance for cluster 3 is much greater than the AZNMM ecoregion and the median abundance for cluster 1 is much less than for the SD ecoregion.

Similarly, the distribution of the mayfly, *Epeorus* is considerably different for clusters than ecoregions. The cluster 3 median abundance is much greater than that of the AZNMM ecoregion. Also the presence and abundance of *Epeorus* in Clusters 1 and 2 is minimal while the SD ecoregion shows greater occurrence and abundance.

The distribution of the turret-cased *Lepidostoma* caddisfly is more distinguishable among clusters than ecoregions. This caddisfly is commonly found only in cluster 3 sites and is rarely found in clusters 1 and 2. In contrast, this species was found in similar distributions among both the AZNMM and SD ecoregions. The median abundance of the turret-cased *Lepidostoma* is also greater in cluster 3 than in the AZNMM ecoregion. The boxplots for these three taxa show that clusters describe their distribution better than ecoregions. These taxa also show promise for use as potential indicator taxa, taxa which, when found at certain densities may be used as indicators of that region or cluster.

Spatial Comparison

In general, the currently defined ecoregion concept has been shown to have limitations as a regional model for explaining macroinvertebrate distribution in Arizona. The empirically derived clusters provide a starting point for developing a new grouping paradigm. The differences between ecoregion and cluster regional boundaries within the state of Arizona are shown by the spatial distribution of cluster reference zones overlaid onto ecoregions in Figure 13. These cluster boundaries are not geographically defined areas, rather they are boundaries drawn to encompass reference sites sampled in 1992 which have similar macroinvertebrate communities. The spatial comparison of generalized cluster areas and ecoregions shows that all three upland, lowland and transition zone clusters are found in the Southern Deserts ecoregion and the Arizona/New Mexico Mountains ecoregion. This explains the larger ecoregion variance for each metric discussed in the previous section.

The clusters of sites and species presented here are tentative, representing only streams which have been sampled as reference sites. Actual contours of the clusters will have to be tested by comparison with other topographic, climatic or vegetation models and with macroinvertebrate information on other streams and with additional data collected in 1993 and 1994. However the finding of three physiographically different clusters appears to fit the 1992 dataset better than ecoregions and the potential indicator taxa appear to make sense, in terms of known habitat requirements.

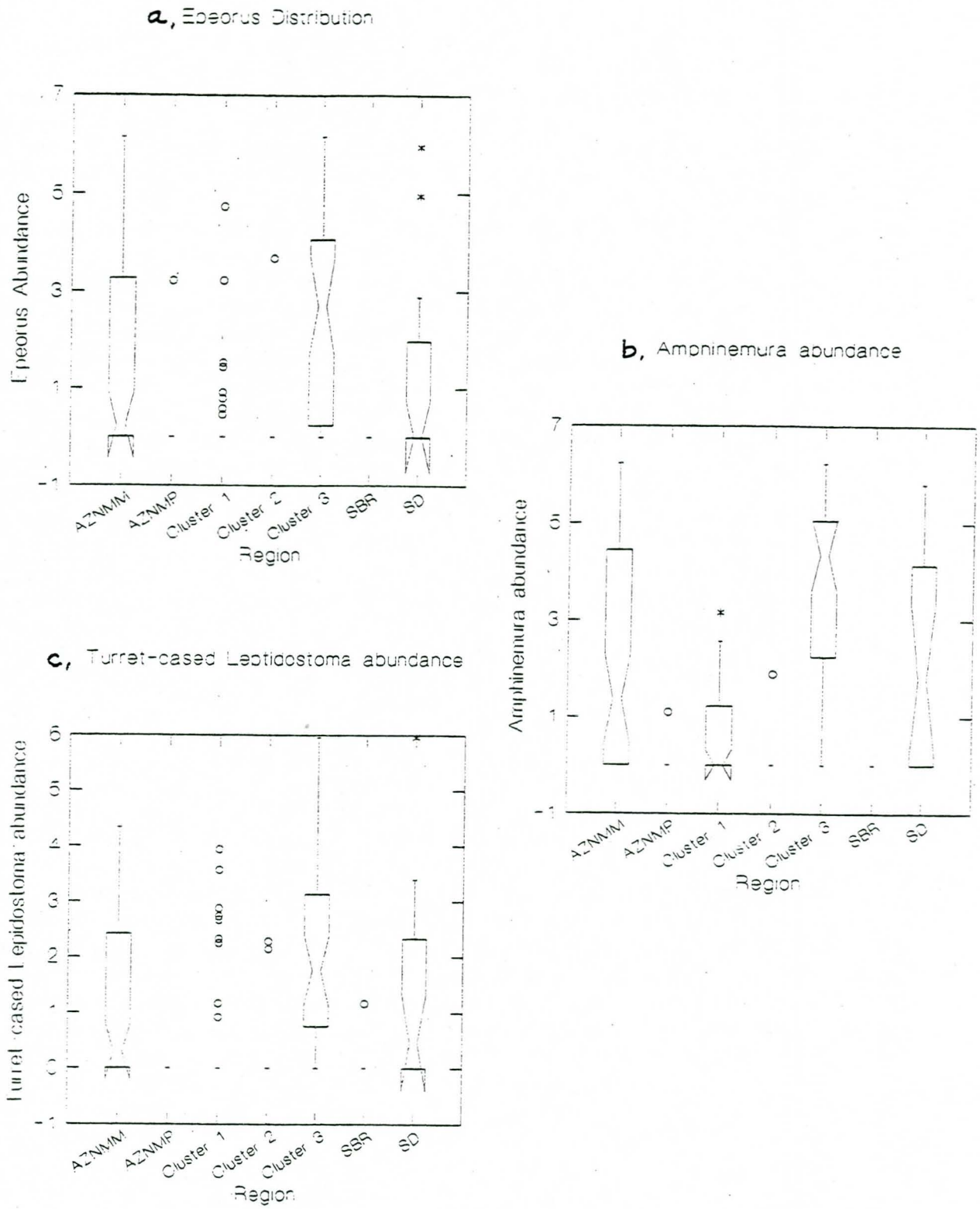


Figure 12. Box and whisker plots of selected EPT taxa at 1992 Arizona reference sites. Variance in taxa distribution among and between clusters and ecoregions is compared (a, *Epeorus*; b, *Amphinemura*; c, Turret cased *Lepidostoma*; AZNMM, Arizona-New Mexico Mountains Ecoregion; AZNMP, Arizona-New Mexico Plateau; SBR, Southern Basin and Range; SD, Southern Deserts; Cluster 1, Transition zone streams; Cluster 2, Desert streams; Cluster 3, Montane streams)

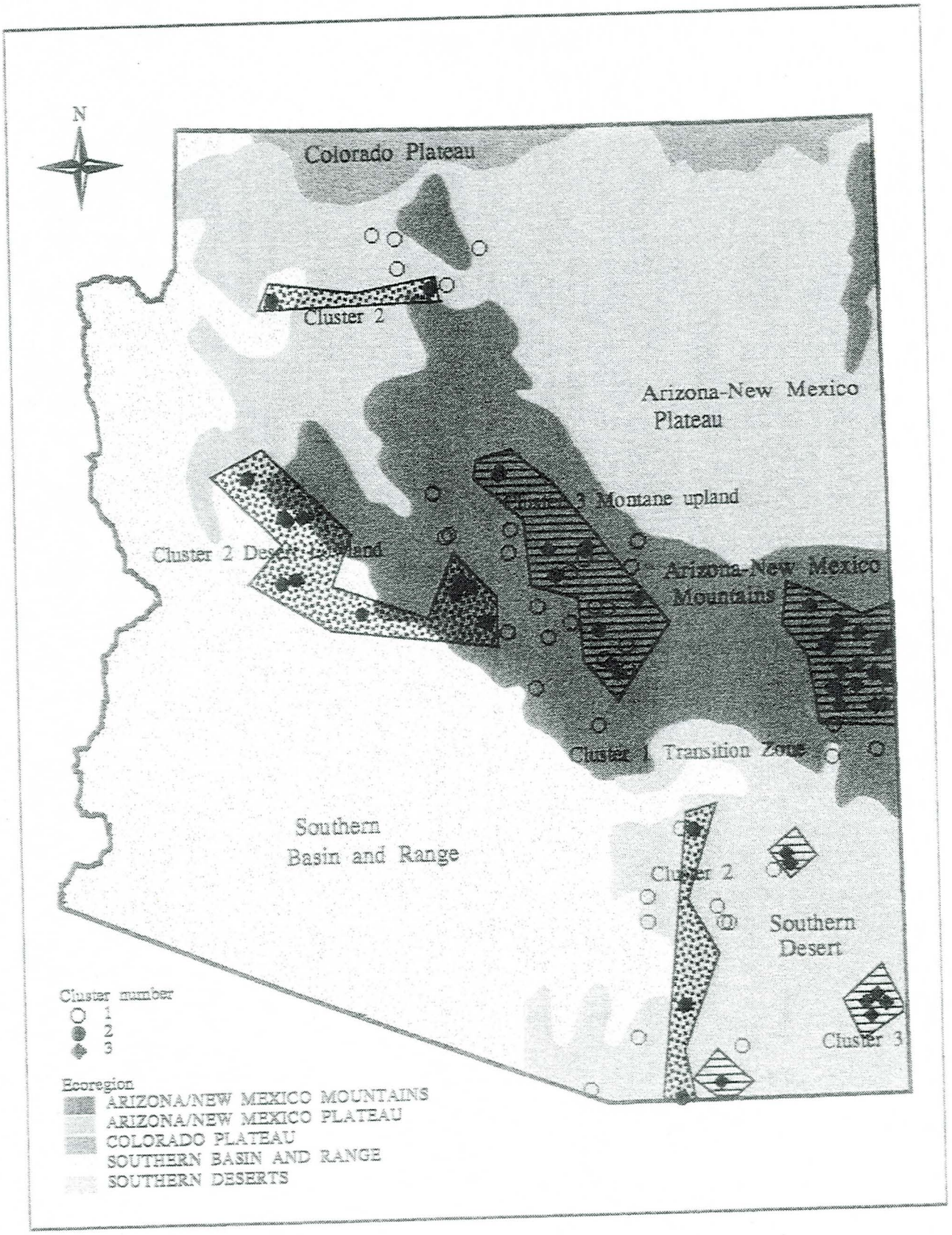


Figure 13. Distribution of Arizona reference sites among clusters and ecoregions in 1992.

SUMMARY

Analyses of the 1992 dataset showed that macroinvertebrate communities in Arizona are not correlated with ecoregions in a consistent manner. They especially do not fit for the Arizona-New Mexico Mountains and Southern Deserts ecoregions where there is a large transition zone in elevation and vegetation type and where sky islands are present. Nor do macroinvertebrate communities reflect surface watershed boundaries. These communities seem instead to correspond most with elevation and watershed area. These variables do not describe contiguous areas of the state. Rather the clusters of macroinvertebrate communities and their related environmental characteristics appear to be as disjointed as the topography of the state. A cluster analysis provides a new grouping paradigm of three clusters which are described as 1) A montane upland stream ecosystem, 2) a desert lowland ecosystem, and 3) a large transition zone between the other two. The clustering method appeared to define the macroinvertebrate community structure more accurately than ecoregions, as shown by boxplot analyses.

How are the macroinvertebrate communities defined within these clusters? The communities are described by several metrics and the distribution of the EPT taxa. The community of the montane cluster contains the greatest EPT richness and greatest composition by shredders. The community of the desert lowland cluster has the greatest percentage of Hydropsychidae/total Trichoptera, relatively more EPT taxa/Chironomidae, and the community is relatively more tolerant of organic pollution than the other clusters as determined by HBI scores. In addition, the desert lowland community is composed of greater percentages of Odonata and Hemiptera.

The community of the transition zone is composed of fewer EPT taxa, the mayflies are more dominated by Baetidae than the other clusters, and the community is composed of a greater percentage of Megaloptera and Diptera (composed of about 100 Chironomidae taxa) than the other clusters. On closer inspection, these transition zone streams typically have a high gradient and large watershed area, such that the stream power due to spring flooding may have a greater disturbance effect than in other streams. Thus more disturbance tolerant macroinvertebrates are found there. Additional testing of this hypothesis will be performed using the 1993 and 1994 datasets.

A closer look at EPT taxa shows some expected patterns of distribution in montane streams as well as new information about macroinvertebrate distribution in desert streams. In general, stoneflies were mainly found in high elevation, cold water montane streams of cluster 1 and 3. Taxa of the families Taeniopterygidae and Capniidae were found primarily in moderate elevation cluster 1 transition zone sites. Mayflies were widely distributed, though *Ameletus, Cinygmula, Epeorus, Ephemerella,* and *Paraleptophlebia* were typically found in cluster 3 montane streams. Several taxa were ubiquitous among all sites but were the dominant taxa in desert streams of cluster 2. These included: Baetidae larvae, *Caenis, Choroterpes/Thraulodes*, other Leptophlebiidae larvae, and *Tricorythodes*. Mayflies of transition zone streams included *Isonychia, Rhithrogena, Serratella*, and *Traverella*. Many caddisfly taxa were found in high elevation streams, including taxa of the families Brachycentridae, Glossosomatidae, Lepidostomatidae and Limnephilidae. Taxa of the family Hydroptilidae were ubiquitous among all clusters. Caddisfly taxa commonly found in the larger order streams draining large watershed areas included *Hydropysche, Cheumatopsyche* and *Leptonema*. Caddisflies of the desert lowland assemblage consist of taxa common to all Arizona streams which are simply more abundant in desert streams.

These results are only preliminary results from one year of analysis (1992). These analyses and the cluster paradigm will be tested again using the 1993 and 1994 data sets and more definite cluster boundary lines can then be drawn. These clusters appear to show promise in terms of separating upland and lowland fauna more accurately than ecoregions. The new cluster paradigm, if shown to be a reproducible grouping structure, can then be used in the next steps of developing narrative and numeric biocriteria for the surface water quality standards and in performing bioassessments.

While work is ongoing to analyze the 1993 and 1994 datasets, our sampling methodologies and analytical methods are also being studied. Several topics are being researched which will make our sampling strategy more efficient. Once these topics have been studied, the ADEQ biological sampling protocol document can be finalized. The following topics are on the agenda for further research.

A. Four questions relating to taxonomic effort and analysis need to be studied:

1) How important are the Chironomidae in differentiating between communities in different clusters and in differentiating between impacted and reference sites. Can we reduce the amount of taxonomic effort by omitting these taxa from analysis?

2) How important are rare taxa in differentiating between reference community clusters and between impacted and reference sites?

3) What taxonomic level of identification provides enough information to determine whether a site is impacted compared with the reference community? Do we need genus level taxonomic identifications or will family level information suffice?

4) How do algal communities compare to the macroinvertebrates in terms of their regional distribution? The algae dataset will be used to test the ecoregion and cluster concepts. With additional study, it is hoped that the algae can also be used for performing bioassessments.

B. Three methodology questions need to be answered:

1) Do macroinvertebrate samples from riffles adequately represent the fauna at reference sites and should we continue to sample pool habitats and integrate pool data into analyses? A comparison of paired riffle and pool data from reference sites should show whether there is a significant difference in community structure, whether the taxa present are different, and whether any taxa found only in pools are needed to make assessments of the biota in non-reference streams.

2) Is seasonal sampling of macroinvertebrates necessary? Are macroinvertebrate samples collected in the spring sufficiently representative of the biota normally found at reference sites? A comparison of data collected during the spring and fall will be analyzed to determine the similarity between the two datasets, or if different, what are the additional species represented and how important are they in making assessments.

3) Are microhabitat samples needed to obtain the most complete taxa list for a study site? Does sampling microhabitats provide significant additional information to justify the expense of additional field time? The microhabitat taxa list will be compared with the riffle plus pool dataset to determine whether a significant number or important types of taxa are present in the microhabitat sample.

LITERATURE CITED

ADEQ, 1992. The Arizona Water Quality Assessment Report for 1992 (Water Years 1987-91), Clean Water Act Section 305(b) Report. Arizona Department of Environmental Quality, Phoenix, AZ. 176 pp.

AAC, 1992. State of Arizona Surface Water Quality Standards, Arizona Administrative Code (AAC), Title 18, Chapter 11, Article 1, Section 112. Office of the Secretary of State, Phoenix, AZ. 40 pp.

ADEQ, 1995. In Press. Quality Assurance Project Plan for Arizona. Phoenix, AZ.

APHA, 1989. Standard methods for the examination of water and wastewater, 17th edition. L.S. Clesceri, A.E. Greenberg, and R.R. Trussell, editors. American Public Health Association, American Water Works Association, Water Pollution Control Federation, Washington, D.C.

Aquatic Biology Associates, 1993. Taxonomic analysis of benthic macroinvertebrate samples, spring and fall 1992, winter 1993 for ADEQ. Corvallis, OR.

Bahls, L.L., 1993. Periphyton bioassessment methods for Montana streams. Montana Water Quality Bureau, Helena, MT. 47 pp.

Bahls, L.L., R. Bukantis, and S. Tralles, 1992. Benchmark biology of Montana reference streams. Montana Department of Helath and Environmental Sciences, Helena, MT. 47 pp.

Bailey, R.G., 1983. Delineation of ecosystem regions. Environmental Management 7:365-373.

Barbour, M.T., J.L. Plafkin, B.P. Bradley, C.G. Graves, and R.W. Wisseman, 1992. Evaluation of EPA's rapid bioassessment benthic metrics: metric redundancy and variability among reference stream sites. Environmental Toxicology and Chemistry 11:437-449.

Blinn, D.W. and M.W. Sanderson, 1989. Aquatic insects in Montezuma Well, Arizona, USA: a travertine spring mound with high alkalinity and dissolved carbon dioxide. Great Basin Naturalist 49(1):85-88.

Boulton, A.J., H.M. Valett and S.G. Fisher, 1992. Spatial distribution and taxonomic composition of the hyporheos of several Sonoran desert streams. Archives fur Hydrobiologie 125(1):37-61.

Brown, D.E, 1994. Biotic communities: southwestern United States and northwestern Mexico. D.E. Brown, editor, University of Utah Press, Salt Lake City.

Bruns, D.A. and W.L. Minckley, 1980. Distribution and abundance of benthic invertebrates in a Sonoran desert stream. Journal of arid environments 3:117-131.

Busch, D.E. and S.G. Fisher. 1981. Metabolism of a desert stream. Freshwater biology 11:301-307.

Davies, S.P., L. Tsomides, D.L. Courtemanch, and F. Drummond, 1993. Maine biological monitoring and biocriteria development program. Maine Department of Environmental Protection. 59 pp.

Ellsworth, P.M., 1994. Biomonitoring macroinvertebrate survey, Upper Verde River, 3rd year. Prescott National Forest, Chino Valley Ranger District.

Fisher, S.G., L.J. Gray, N.B. Grimm, and D.E. Busch, 1982. Temporal succession in a desert stream ecosystem following flash flooding. Ecological Monographs 52(1):93-110.

Gray, L.J. 1980. Species composition and life histories of aquatic insects in a lowland Sonoran desert stream. The American Midland Naturalist 106(2):229-242.

Heald, W.F., 1951. Sky islands of Arizona. Natural History 60:56-63, 95-96.

Hill, M.O. 1979. DECORANA; A FORTRAN program for detrended correspondence analysis and reciprocal averaging. Cornell University, Ithaca, New York. 30 pp.

Hilsenhoff, W.L., 1988. Rapid field assessment of organic pollution with a family-level biotic index. Journal of the North American Benthological Society 7(1):65-68.

Hughes, R.M. and D.P. Larsen, 1988. Regional reference sites: a method for assessing stream potentials. Environmental Management 10(5):629-635.

Karr, J.R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6:21-27.

Karr, J.R., K.D. Fausch, P.L Angermeier, P.R. Yant, and I.J. Schlosser. 1986. Assessing biological integrity in running waters: a method and its rationale. Illinois Natural History Survey Special Publication 5. 28 pp.

Klemm, D.J., P.A. Lewis, F. Fulk, and J.M. Lazorchak, 1990. Macroinvertebrate field and laboratory methods for evaluating the biological integrity of surface waters. EPA/600/4-90/030. United States Environmental Protection Agency, Cincinnati, OH. 256 pp.

Lenat, D.R., 1983. Water quality assessment using a new qualitative collection method for freshwater benthic macroinvertebrates. North Carolina Division of Environmental Management, Raleigh, NC. 12 pp.

Mangum, F.A., 1990. Aquatic ecosystem inventory, macroinvertebrate analysis. Arizona Game and Fish Department and the Apache-Sitgreaves National Forest.

Metzmeier, L., 1993. Methods for Assessing biological integrity of surface waters. Kentucky Department for Environmental Protection, Frankfort, KY. 139 pp.

Meyerhoff, R.D. and P.H. Spindler, 1994. Biological sampling protocols: reference site selection and sampling methods. Arizona Department of Environmental Quality, Phoenix, AZ. 23 pp.

Ohio Environmental Protection Agency, 1990. The use of biocriteria in the Ohio EPA surface water monitoring and assessment program. Ohio EPA, Columbus, OH. 52 pp.

Omernik, J.M. 1987. Ecoregions of the conterminous United States. Annals of the Association of American Geographers 77(1): 118-125.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes, 1989. Rapid Bioassessment Protocols for use in streams and rivers, benthic macroinvertebrates and fish. United States Environmental Protection Agency, EPA/444/4-89-001.

Plotnikoff, R.W., 1992. Ecoregion bioassessment pilot project. Washington State Department of Ecology, Olympia, WA. 57 pp.

Runck, C. and D.W. Blinn, 1993. Secondary production by *Telebasis salva* (Odonata) in a thermally constant aquatic ecosystem. Journal of the North American Benthological Society 12(2):136-147.

Shackelford, B. 1988. Rapid bioassessments of lotic macroinvertebrate communities: biocriteria development. Arkansas Department of Pollution Control and Ecology, Little Rock, Arkansas. 45 pp.

Smith, R.L., 1986. Elements of ecology, 2nd ed. Harper and Row, Publishers, Inc., New York, New York. pp. 450-451.

Sokal, R.R. and F.J. Rohlf. 1981. Biometry, the principles and practice of statistics in biological research, 2nd ed. W.H. Freeman and Company, New York. 859 pp.

USFS. 1993. Potential wild, scenic, recreational river designation resource information report for the National Forests of Arizona. US Department of Agriculture, US Forest Service, Southwestern Region. 375 pp.

Vannote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing, 1980. The river continuum concept. Canadian Journal of Fisheries and Aquatic Sciences 37:130-137.

Wilkinson, L. and M. Hill, 1994. SYSTAT for DOS, Version 6. SYSTAT Inc., Evanston, IL.

APPENDIX A.

Geographic and topographic data for Arizona sampling locations, 1992.
(A1-A4)

Appendix A. Geographic and topographic data for Arizona sampling locations, 1992.

SAMPLE SITES - 1992	ADEQ SITE CODE	HUC CODE	SEGMENT NO.	ECOREGION	LATITUDE	LONGITUDE	WATERSHED AREA (km2)	GRADIENT (ft/ft) (0.5 mi)	ELEVATION meters (ft)
LITTLE COLORADO BASIN									
Barbershop Canyon (Lower)	BAR2-00RF	15020008	AAA	AM	342942	1110951	53.6	0.021	1987 (6520)
Barbershop Canyon (Upper)	BAR1-00RF	15020008	AAA	AM	343250	1110942	19.6	0.013	2118 (6950)
Chevelon Canyon (Chevelon Crossing)	CHV4-00IM	15020010	006	AM	342520	1105109	273.6	0.003	1868 (6130)
Chevelon Canyon (Long Tom)	CHV2-00RF	15020010	006	AM	343522	1104715	121.4	0.008	1992 (6535)
Chevelon Canyon (Telephone Ridge)	CHV3-00RF	15020010	006	AM	342628	1105022	153.4	0.006	1972 (6470)
East Clear Cr. (Kinder Crossing)	ECL1-00RF	15020008	009	AM	343400	1110848	269.8	0.004	1966 (6450)
East Clear Cr. (Macks Crossing)	ECL2-00RF	15020008	008	AM	343710	1110534	343.3	0.006	1910 (6265)
East Fk Little Colorado R.	ELC1-00RF	15020001	DDD	AM	335534	1092948	4.3	0.023	2877 (9440)
Lily Cr.	LIL1-00RF	15020001	BBB	AM	335837	1090532	1.5	0.114	2627 (8620)
Little Colorado R. (Mouth)	LCR9-00RF	15020016	001	AP	361130	1114730	56731.4	0.004	841 (2760)
Little Colorado R. (abv S. Fk.)	LCR1-00RF	15020001	011	AM	340439	1092535	176.3	0.049	2283 (7490)
Little Colorado R. (blw Nutrioso)	LCR3-00IM	15020001	009	AM	341040	1091808	915.0	0.025	2063 (6770)
Little Colorado R. (blw S. Fk.)	LCR2-00IM	15020001	011	AM	340511	1092409	244.9	0.015	2227 (7305)
Mamie Cr.	MAM1-00RF	15020001	AAA	AM	335803	1090456	5.5	0.061	2618 (8590)
Mineral Cr.	MIN1-00RF	15020002	AAA	AM	341050	1093704	16.3	0.072	2460 (8070)
Paddy Cr.	PAD1-00RF	15020001	CCC	AM	335504	1090903	11.5	0.047	2586 (8485)
Rudd Cr.	RUD1-00RF	15020001	EEE	AM	340039	1091651	13.1	0.049	2469 (8100)
S. Fk. Little Colorado R.	SLC1-00RF	15020001	014	AM	340424	1092438	60.1	0.040	2323 (7620)
West Fk. Little Colorado R. (Lower)	WLC2-00RF	15020001	013	AM	335910	1092804	28.7	0.027	2606 (8550)
West Fk. Little Colorado R. (Upper)	WLC1-00RF	15020001	013	AM	335724	1093103	14.3	0.013	2816 (9240)
UPPER GILA BASIN									
Blue R. (Lower)	BLU4-00RF	15040004	025	AM	331940	1091124	1268.29	0.009	1314 (4310)
Blue R. (Upper)	BLU1-00RF	15040004	027	AM	334100	1090456	298.37	0.009	1862 (6110)
Campbell Blue R.	CMB1-00RF	15040004	028	AM	334418	1090600	122.38	0.017	2033 (6670)
Coleman Cr.	COL1-00RF	15040004	DDD	AM	334620	1091113	24.40	0.038	2393 (7850)
Eagle Cr. (Honeymoon)	EAG1-00RF	15040005	028	AM	332844	1092839	261.89	0.017	1657 (5435)
Eagle Cr. (Sheep Wash)	EAG3-00RF	15040005	025	AM	331738	1092940	985.25	0.008	1416 (4645)
East Turkey Cr.	ETK1-00RF	15040006	BBB	SD	315430	1091516	5.19	0.136	1987 (6520)
Frye Cr.	FRY1-00RF	15040005	BBB	SD	324437	1095018	10.35	0.121	1768 (5800)
Grant Cr. (Blue)	GRB1-00RF	15040004	BBB	AM	323903	1095530	48.01	0.038	1701 (5580)
Grant Cr. (Pinaleno)	GRP1-00RF	15050201	BBB	SD	333445	1091119	24.98	0.114	1707 (5600)
Lanphier Canyon	LAN1-00RF	15040004	CCC	AM	333510	1090744	26.83	0.047	1745 (5725)
Marijilda Cr.	MAR1-00RF	15040005	AAA	SD	324101	1094842	12.70	0.144	1682 (5520)
San Francisco R. (Blue)	SFR1-00RF	15040004	003	AM	330814	1091642	7132.93	0.004	1096 (3595)
South Fk Cave Cr.	SFC1-00RF	15040006	AAA	SD	315113	1091132	28.75	0.030	1679 (5510)

Appendix A. Geographic and topographic data for Arizona sampling locations, 1992.

SAMPLE SITES - 1992	ADEQ SITE CODE	HUC CODE	SEGMENT NO.	ECOREGION	LATITUDE	LONGITUDE	WATERSHED AREA (km2)	GRADIENT (ft/ft) (0.5 mi)	ELEVATION meters (ft)
UPPER SALT BASIN									
Conklin Cr.	CKN1-00RF	15060101	HHH	AM	334054	1092642	18.93	0.049	2195 (7200)
East Fork Black R.	EFB1-00RF	15060101	009	AM	334926	1091746	264.29	0.015	2414 (7920)
Horton Cr.	HOR1-00RF	15060101	AAA	AM	334209	1091855	9.81	0.047	2437 (7995)
N. Fk. Bear Wallow Cr.	NBW1-00RF	15060101	DDD	AM	333546	1092600	16.08	0.045	2359 (7740)
Reservation Cr.	RES1-00RF	15060101	CCC	AM	334145	1092836	58.94	0.042	2070 (6790)
West Fork Black R.	WFB1-00RF	15060101	010	AM	334746	1092524	90.12	0.015	2377 (7800)
MIDDLE SALT BASIN									
Campaign Cr.	CGN1-00RF	15060103	AAA	AM	333127	1110512	24.92	0.044	1023 (3355)
Canyon Cr.	CYN1-00RF	15060103	014	AM	341515	1104742	74.26	0.013	1911 (6270)
Cherry Cr. (Lower)	CHE2-00RF	15060103	015	AM	335034	1105236	446.50	0.013	972 (3190)
Cherry Cr. (Upper)	CHE1-00RF	15060103	015	AM	335903	1105300	249.82	0.009	1338 (4390)
Deer Cr.	DEE1-00RF	15060105	AAA	AM	340235	1112511	20.85	0.059	1106 (3630)
Greenback Cr.	GRE1-00RF	15060105	005	AM	335036	1110914	48.12	0.034	1109 (3640)
Haigler Cr.	HAI1-00RF	15060105	012	AM	341212	1110028	91.85	0.044	1484 (4870)
Reynolds Cr.	REY1-00RF	15060103	CCC	AM	335232	1105917	37.23	0.028	1544 (5065)
Salome Cr.	SAL1-00RF	15060103	022	AM	335430	1110214	49.75	0.021	1469 (4820)
Spring Cr.	SPG1-00RF	15060105	010	AM	340450	1110432	226.87	0.013	1298 (4260)
Tonto Cr. (Gisela)	TON1-00RF	15060105	009	AM	340739	1111557	1062.20	0.013	899 (2950)
Workman Cr.	WOR1-00RF	15060103	BBB	AM	334926	1105618	7.22	0.098	1878 (6160)
SAN PEDRO/WILLCOX BASINS									
Aravaipa Canyon (East)	ARA1-00RF	15050203	004	SD	325412	1102740	1036.59	0.006	908 (2980)
Aravaipa Canyon (West)	ARA2-00RF	15050203	004	SD	325436	1103300	1278.05	0.006	808 (2650)
Bass Canyon	BAS1-00RF	15050203	AAA	SD	322106	1101405	87.12	0.021	1231 (4040)
Goudy Cr.	GOU1-00RF	15050201	CCC	SD	323912	1095712	17.83	0.085	1646 (5400)
Hot Springs Canyon	HSC1-00RF	15050203	013	SD	322118	1101616	246.18	0.009	1167 (3830)
Ramsey Canyon	RAM1-00RF	15050202	AAA	SD	312612	1101908	7.15	0.114	1882 (6175)
Redfield Canyon	RED1-00RF	15050203	014	SD	322705	1101854	94.99	0.025	1189 (3900)
San Pedro R.	SPR1-00RF	15050202	006	SD	313842	1101042	3196.00	0.003	1195 (3920)
Ward Canyon	WAR1-00RF	15050201	AAA	SD	315152	1091952	7.68	0.091	1908 (6260)

Appendix A. Geographic and topographic data for Arizona sampling locations, 1992.

SAMPLE SITES - 1992	ADEQ SITE CODE	HUC CODE	SEGMENT NO.	ECOREGION	LATITUDE	LONGITUDE	WATERSHED AREA (km2)	GRADIENT (ft/ft) (0.5 mi)	ELEVATION meters (ft)
SANTA CRUZ BASIN									
Canada del Oro Cr.	CDO1-00RF	15050301	BBB	SB	323100	1104700	38.73	0.040	1402 (4600)
Cave Cr.	CAV1-00RF	15050302	BBB	SD	314254	1104936	2.37	0.193	1932 (6340)
Cienega Cr.	CIE1-00RF	15050302	006	SD	315306	1103313	516.26	0.008	1234 (4050)
Gardner Cr.	GAR1-00RF	15050302	AAA	SD	314206	1104903	3.81	0.106	1850 (6070)
Madera Cr.	MAD1-00RF	15050301	CCC	SD	314216	1105158	2.65	0.191	1847 (6060)
Sabino Cr.	SAB1-00RF	15050302	CCC	SB	322213	1104703	47.13	0.045	1134 (3720)
Santa Cruz R.	SCR1-00RF	15050301	AAA	SD	312057	1103524	252.85	0.004	1411 (4630)
VERDE BASIN									
Black Canyon	BLC1-00RF	15060202	AAA	AM	343914	1120629	11.86	0.042	1829 (6000)
East Verde R. (Brushy Canyon)	EVD3-00RF	15060203	022	AM	341710	1112200	388.94	0.011	1318 (4325)
East Verde R. (Ellison)	EVD1-00RF	15060203	022	AM	342128	1111655	135.57	0.013	1574 (5165)
Oak Cr. (Baldwin Crossing)	OAK6-00IM	15060202	018	AM	344930	1114826	664.13	0.008	1202 (3945)
Oak Cr. (Chavez Crossing)	OAK5-00IM	15060202	018	AM	345034	1114636	647.65	0.009	1244 (4080)
Oak Cr. (Grasshopper Pt.)	OAK4-00IM	15060202	018	AM	345310	1114355	588.56	0.017	1334 (4375)
Oak Cr. (Pine Flat)	OAK1-00RF	15060202	019	AM	350054	1114413	222.79	0.027	1692 (5550)
Oak Cr. (Red Rock)	OAK7-00IM	15060202	018	AM	344840	1114924	698.79	0.008	1173 (3850)
Pine Cr.	PIN1-00RF	15060203	DDD	AM	341330	1112912	119.24	0.021	1024 (3360)
Roundtree Cr.	ROU1-00RF	15060203	BBB	AM	340808	1115053	28.60	0.030	1006 (3300)
Sycamore Cr. (Horseshoe)	SYH1-00RF	15060203	AAA	AM	340448	1114206	75.86	0.023	634 (2080)
Sycamore Cr. (Mazatzal)	SYM1-00RF	15060203	002	AM	334415	1113055	291.14	0.008	628 (2060)
Verde R. (Perkinsville)	VER1-00RF	15060202	038	AM	345338	1121244	6614.23	0.003	1164 (3820)
Webber Cr.	WEB1-00RF	15060203	EEE	AM	342356	1112151	26.65	0.025	1640 (5380)
West Clear Cr. (Lower)	WCC3-00RF	15060203	026	AM	343220	1114100	579.11	0.011	1116 (3660)
West Clear Cr. (Upper)	WCC1-00RF	15060203	026	AM	343320	1112432	350.41	0.009	1824 (5985)
West Fork Oak Cr.	WFO1-00RF	15060202	020	AM	345954	1114512	111.47	0.027	1618 (5310)
Wet Beaver Cr.	WBV1-00RF	15060202	007	AM	344026	1114012	286.89	0.025	1227 (4025)
RIO DE MEXICO BASINS									
Rucker Cr.	RUC1-00RF	15080301	AAA	SD	314707	1091705	18.65	0.030	1896 (6220)
Sycamore Cr. (Sonora)	SYS1-00RF	15080200	002	SD	312440	1111139	29.11	0.021	1155 (3790)

Appendix A. Geographic and topographic data for Arizona sampling locations, 1992.

SAMPLE SITES - 1992	ADEQ SITE CODE	HUC CODE	SEGMENT NO.	ECOREGION	LATITUDE	LONGITUDE	WATERSHED AREA (km2)	GRADIENT (ft/ft) (0.5 mi)	ELEVATION meters (ft)
MIDDLE GILA BASIN									
Agua Fria R.	AGF1-00RF	15070102	023	AM	341850	1120337	1521.54	0.008	1050 (3445)
Antelope Cr.	ANT1-00RF	15070103	010	SB	341146	1124252	13.42	0.053	1173 (3850)
Ash Cr.	ASH1-00RF	15070102	028	AM	343818	1120738	8.61	0.053	1859 (6100)
Hassayampa R. (Lower)	HAS3-00RF	15070103	002	SB	355536	1124108	1969.92	0.006	587 (1925)
Hassayampa R. (Upper)	HAS1-00RF	15070103	007	AM	342515	1123127	106.19	0.023	1448 (4750)
Lion Canyon	LIO1-00RF	15070103	AAA	SB	341016	1124137	6.03	0.117	1173 (3850)
Little Ash Cr.	LAC1-00RF	15070102	AAA	AM	342301	1120130	113.13	0.017	1170 (3840)
Poland Cr.	POL1-00RF	15070102	037	AM	341432	1121502	70.05	0.044	939 (3080)
Sycamore Cr. (Dugas)	SYD1-00RF	15070102	024	AM	342050	1115654	92.84	0.017	1247 (4090)
BILL WILLIAMS BASIN									
Burro Cr.	BUR1-00RF	15030202	009	SB	344437	1131422	438.26	0.013	945 (3100)
Conger Cr.	CGR1-00RF	15030202	AAA	SB	344539	1130750	39.46	0.068	1329 (4360)
Date Cr.	DAT1-00RF	15030203	003	SB	341400	1130050	201.50	0.011	911 (2990)
Francis Cr.	FRA1-00RF	15030202	012	SB	344548	1131548	330.35	0.019	991 (3250)
Peeples Canyon	PEE1-00RF	15030203	AAA	SB	342235	1131615	14.99	0.057	756 (2480)
Santa Maria R.	SMR1-00RF	15030203	012	SB	342358	1131024	1995.53	0.011	558 (1830)
Trout Cr.	TRT1-00RF	15030201	014	AP	345918	1133114	1330.80	0.027	985 (3230)
NORTHERN COLORADO MAINSTEM BASIN									
Bright Angel Cr.	BRA1-00RF	15010001	019	AP	360608	1120550	267.48	0.027	768 (2520)
Havasu Cr.	HAV1-00RF	15010004	001	AP	361815	1124530	7681.70	0.023	561 (1840)
Hermit Cr.	HER1-00RF	15010002	CCC	AP	360450	1121310	25.20	0.246	890 (2920)
Kanab Cr.	KAN1-00RF	15010003	001	AP	362335	1123755	5986.99	0.011	573 (1880)
Matkatamiba Cr.	MAT1-00RF	15010002	BBB	AP	362030	1124015	85.37	0.030	579 (1900)
Nankoweap Cr.	NAN1-00RF	15010001	AAA	AP	361835	1115135	91.46	0.072	853 (2800)
Paria R.	PAR1-00RF	14070007	001	AP	365148	1113600	3260.57	0.008	951 (3120)
Royal Arch Cr.	ROY1-00RF	15010002	DDD	AP	361150	1122700	39.84	0.250	658 (2160)
Spring Canyon	SPC1-00RF	15010002	AAA	SB	360107	1132109	57.32	0.053	457 (1500)
Tapeats Cr.	TAP1-00RF	15010002	EEE	AP	362215	1122750	217.89	0.042	610 (2000)

APPENDIX B.

Constituents, method numbers and detection limits for stream water samples collected at Arizona sampling sites in 1992.

Appendix B. Constituents, method numbers and detection limits for stream water samples collected at 108 Arizona reference sites, 1992.

Parameter Group	Constituent	EPA Method	Detection Limit
Nutrients	Nitrate + Nitrite	353.3	0.010
	Kjeldahl Nitrogen	351.3	0.100
	Ammonia	350.2	0.010
	Phosphorus	365.3	0.010
Cations	Calcium	200.7	1.0
	Magnesium	200.7	1.0
	Sodium	200.7	5.0
	Potassium	258.1	0.500
Anions	Chloride	SM4500Cl D	1.0
	Fluoride	340.2	0.200
	Sulfate	375.2	10.0
	Bicarbonate	Calculated	2.0
Miscellaneous	Alkalinity, T	310.1	2.0
	Alkalinity, P	310.1	2.0
	Conductivity	120.1	
	Hardness	130.2	10.0
	pH	150.1	
	TDS	160.1	10.0
	TSS	160.2	4.0
	Turbidity	180.1	0.010
Total metals	Ag, Silver	272.2	0.001
	As, Arsenic	200.9	0.010
	B, Boron	200.7	0.100
	Ba, Barium	200.7	0.100
	Cd, Cadmium	213.2	0.001
	Cr, Chromium	218.2	0.010
	Cu, Copper	220.2	0.010
	Fe, Iron	200.7	0.100
	Hg, Mercury	245.1	0.0005
	Mn, Manganese	200.7	0.050
	Pb, Lead	239.2	0.005
	Se, Selenium	200.9	0.005
	Tl, Thallium	279.2	0.005
	Zn, Zinc	200.7	0.050

APPENDIX C.

Habitat assessment and site investigation example field forms:

C1. Biocriteria Site Investigation Form
C2-C4. Habitat Assessment Form

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
BIOCRITERIA SITE INVESTIGATION FORM

Site Information:

Date (spell out): _____ Time (24 hrs): _____ Name of Water Body: _____

Site Code #: _____ Elev (ft): _____ Photos: LU _____ LD _____

U.S.G.S. 7.5' Quadrangle: _____ Ownership: _____

Location/Access Description: _____

_____

Physico-chemical Evaluation:

Air T (C): _____ Water T (C): _____ DO (mg/l): _____ DO (% Sat) _____ Conductivity: _____

TDS (g/l): _____ pH: _____ Turbidity: _____ Redox: _____ Battery: _____

Velocity/Discharge: Reach Length (ft): _____ Time (sec): _____ Channel Width (ft): _____

Depth (inches) (at one foot intervals, left → right bank): _____

Field Observations:

Recent flood evidence (circle all that apply): Fresh debris line, grasses laid over, fresh debris suspended in bushes/trees

Estimated width of flood (ft): _____ Other flood evidence: _____

Streambed structure and big picture remarks (e.g., logs, macrophytes, sediment, braiding, boulders, fresh downcutting, etc.):

_____

_____

_____

_____

Wildlife/Fish observed: _____

Human activities: _____

Grazing impacts/Livestock observed: _____

Evidence of NPS pollution (turbidity, large green algal blooms, fish kills, odors, surface films, trash, color): _____

_____

Habitat Evaluation Scores:

1. Riffle substrate/cover	____	7. Pool/Riffle ratio	____	Rating Guide:	
2. Embeddedness	____	8. Lower bank	____		
3. Pool substrate	____	9. Upper bank	____	Optimal:	180 - 148
4. Velocity/Depth	____	10. Grazing impacts	____	Sub-optimal:	147 - 100
5. Shade conditions	____	11. Streamside cover	____	Marginal:	99 - 52
6. Channel shape	____	12. Riparian zone	____	Poor:	51 - 0

Total Habitat Score: _____ Habitat Rating: _____ Percent Pool: _____ Percent Riffle: _____

Sample Collection Information

Collector(s): _____

Samples Collected (indicate with checkmark, note number of jars, and if sample was field split):

Macroinvertebrate - Pool: _____ Algae - Pool: _____

Macroinvertebrate - Riffle: _____ Algae - Riffle: _____

Macroinvertebrate - Microhabitat: _____ Other Sample: _____

Big Picture Remarks Continued: _____

_____

_____

_____

_____

_____

_____

HABITAT ASSESSMENT FORM: Page 1

Site:_____ Date:_____ Name:_____

Habitat Parameter	Habitat Rating Criteria			
Riffle substrate/ instream cover	> 50% mix of cobble, gravel, submerged logs undercut banks, or other stable habitat (other than bedrock).	30-50% mix of cobble, gravel, or other stable habitat. Overall habitat is adequate.	10-30% mix of small cobble, gravel or other stable habitat. Available habitat less than desirable.	< 10 % cobble, gravel, or other stable habitat. Lack of habitat availability is obvious.
	____ 16-20	____ 11-15	____ 6-10	____ 0-5
Embeddedness (Riffles only)	Gravel, cobble, and boulder particles are between 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are between 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are between 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are over 75% surrounded by fine sediment.
	____ 16-20	____ 11-15	____ 6-10	____ 0-5
Pool Substrate	Mixture of all substrate types with cobble, gravel, and firm sand prevalent; vegetation common in water and/or along banks.	Mixture of all substrate, types with firm sand most common; vegetation common in water and/or along banks.	Substrate tends towards mud, clay, shifting sands; relatively little vegetation present in and around pools.	Hard-pan clay or bedrock; little or no vegetation present around pools.
	____ 16-20	____ 11-15	____ 6-10	____ 0-5
Velocity/Depth	Slow/deep; slow/shallow; fast/deep; fast/shallow; good mix of 4 habitats present.	Only 3 of 4 habitats present (loss of fast habitats results in lower score).	Only 2 of the 4 habitats present (loss of fast habitats results in lower score).	Dominated by 1 velocity/ depth habitat type.
	____ 16-20	____ 11-15	____ 6-10	____ 0-5

HABITAT ASSESSMENT FORM: Page 2

Site:_____ Date:_____ Name:_____

Habitat Parameter	Habitat Rating Criteria			
Shade Conditions	A mixture of all conditions - shade, full sun exposure, and various degrees of filtered light.	Covered by sparse canopy; entire surface receives filtered light, OR site is within canyon and orientation allows full sunlight on surface only a few hours/day.	Water surface completely shaded, OR nearly full sunlight reaching water surface. Shading limited to < 3 or 4 hours per day.	Full sun almost always reaches water surface regardless of canopy or canyon conditions.
	____ 12-15	____ 8-11	____ 4-7	____ 0-3
Channel Shape (wetted channel)	Trapezoidal (undercutting banks)	Rectangular (historic erosion, natural or recovering)	Triangular (active erosion, with head cutting)	Inverse trapezoid (Active erosion, poor riparian, not natural)
	____ 12-15	____ 8-11	____ 4-7	____ 0-3
Pool/Riffle Ratio (Distance between riffles divided by stream width)	Ratio: 5-7; Variety of habitat. Repeat pattern of sequence relatively frequent.	Ratio: 7-15; Infrequent repeat pattern. Variety of macrohabitat < optimal.	Ratio: 15-25; Occasional riffle or bend. Bottom contours provide some habitat.	Ratio: > 25; Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat.
	____ 12-15	____ 8-11	____ 4-7	____ 0-3
Lower Bank Channel Capacity	Overbank flows rare. Lower bank W/D ratio < 7.	Overbank flows occasional. W/D ratio 8-15.	Overbank flows common. W/D ratio 15-25.	Peak flows not contained or contained through channelization. W/D ratio > 25.
	____ 12-15	____ 8-11	____ 4-7	____ 0-3

HABITAT ASSESSMENT FORM: Page 3

Site:_____ Date:_____ Name:_____

Habitat Parameter	Habitat Rating Criteria			
Upper Bank Stability	Upper bank stable. No evidence of erosion or bank failure. Side slopes generally < 30°■. Little potential for future problems.	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40° on one bank. Slight potential in extreme floods.	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60° on some banks. High erosion potential during extreme high flows.	Unstable. Many eroded areas. "Raw" areas frequent along straight sections and bends. Side slopes > 60° common.
	____ 9-10	____ 6-8	____ 3-5	____ 0-2
Grazing Impacts	Vegetation minimally disturbed. Almost all potential plant biomass present.	Disruption evident but not affecting community vigor. Vegetative use is moderate, and at least 50% of potential plant biomass remains.	Disruption obvious; some patches of bare soil/closely cropped vegetation present. < 50% of potential plant biomass remains.	Disruption of streambank vegetation is very high. Vegetation has been removed to two inches or less in average stubble height.
	____ 9-10	____ 6-8	____ 3-5	____ 0-2
Streamside Cover	Mixture of shrubs and trees make up dominant vegetation. (Taxa richness good, regeneration evident)	Dominant vegetation is in tree form. (Overstory tree richness low, low regeneration evident)	Dominant vegetation is in shrub form. (Grasses dominate, overstory richness poor, no regeneration)	Dominant vegetation is in form of grasses or forbes, or no vegetation cover at all.
	____ 9-10	____ 6-8	____ 3-5	____ 0-2
Width of Riparian Vegetative Zone	Width of riparian vegetative zone (each side) is at least four times the width of the stream°. Man's activities have not impacted this zone at all. (>1 age class dominant trees)	Width of riparian vegetative zone (each side) is at least two times the width of the stream. Man's activities have minimally impacted this zone. (only 1 age class of dominants)	Width of riparian vegetative zone (each side) is at least as wide as the stream. Man's activities have impacted the riparian zone a great deal. (Few trees, poor cond.,no regen.)	Little or no streamside vegetation due to man-induced activities. (No native riparian trees)
	____ 9-10	____ 6-8	____ 3-5	____ 0-2

■ - Within canyons - focus on evidence of erosion and potential for future problems.

° - Within canyons - focus on evidence of man's activities.

APPENDIX D.

Habitat assessment scores for Arizona reference sites sampled in 1992.
(D1-D3)

Appendix D. Habitat assessment scores for Arizona reference sites sampled in 1992.

SAMPLE SITES - 1992	HABITAT PARAMETERS														TOTAL HABITAT SCORES			
	RIFFLE SUBSTRATE	EMBEDED	POOL SUBSTRATE	VELOCITY/ DEPTH	SHADE CONDITIONS	CHANNEL SHAPE	HABITAT VARIETY	LOWER BANK	UPPER BANK	GRAZING IMPACTS	STREAM COVER	RIPARIAN ZONE	PERCENT POOL	PERCENT RIFFLE	PRIMARY	SECONDARY	TERTIARY	TOTAL
LITTLE COLORADO BASIN																		
Barbershop Canyon (Lower)	18	16	20	14	9	11	12	12	8	10	10	8	80	20	68	44	36	148
Barbershop Canyon (Upper)	19	19	20	15	11	11	13	13	9	10	10	10	70	30	73	48	39	160
Chevelon Canyon (Chevelon Crossing)	0	0	18	8	10	8	8	12	7	9	5	9	100	0	26	38	30	94
Chevelon Canyon (Long Tom)	19	19	20	14	12	14	15	12	10	10	10	10	70	30	72	53	40	165
Chevelon Canyon (Telephone Ridge)	19	19	19	15	10	12	14	12	8	10	10	8	50	50	72	48	36	156
East Clear Cr. (Kinder Crossing)	18	18	18	13	10	12	13	11	10	10	10	10	80	20	67	46	40	153
East Clear Cr. (Macks Crossing)	18	18	16	14	10	12	14	10	10	10	10	8	70	30	66	46	38	150
East Fk Little Colorado R.	18	15	15	13	10	10	12	14	10	8	8	8	20	80	61	46	34	141
Lily Cr.	15	16	16	16	15	13	14	12	10	10	8	10	30	70	63	54	38	155
Little Colorado R. (Mouth)	5	4	6	11	2	2	6	7	6	10	5	6	90	10	26	17	27	70
Little Colorado R. (abv S. Fk.)	19	18	18	18	12	14	13	10	10	10	10	10	40	60	73	49	40	162
Little Colorado R. (blw Nutrioso)	12	8	10	16	2	8	13	9	8	6	3	4	40	60	46	32	21	99
Little Colorado R. (blw S. Fk.)	18	16	10	18	0	8	10	10	4	5	2	2	15	85	60	28	13	101
Mamie Cr.	18	18	15	15	13	14	11	12	9	10	8	8	10	90	66	50	35	151
Mineral Cr.	18	18	16	16	14	14	12	12	10	9	8	7	30	70	68	52	34	154
Paddy Cr.	18	16	16	15	15	15	10	13	9	10	8	8	20	80	65	53	35	153
Rudd Cr.	18	13	11	15	15	13	13	12	7	10	9	9	25	75	57	53	35	145
S. Fk. Little Colorado R.	19	20	16	16	12	10	12	10	8	9	9	8	25	75	71	44	34	149
West Fk. Little Colorado R. (Lower)	19	16	17	20	14	13	11	15	10	10	8	10	25	75	72	53	38	163
West Fk. Little Colorado R. (Upper)	18	18	16	16	7	11	12	14	10	10	8	8	20	80	68	44	36	148
UPPER GILA BASIN																		
Blue R. (Lower)	18	16	12	20	7	11	14	9	10	10	8	8	40	60	66	41	36	143
Blue R. (Upper)	16	13	13	18	10	9	14	9	8	8	8	5	40	60	60	42	29	131
Campbell Blue R.	16	16	17	11	7	8	13	8	5	8	8	5	30	70	60	36	26	122
Coleman Cr.	20	18	18	16	15	14	12	14	10	10	9	10	30	70	72	55	39	166
Eagle Cr. (Honeymoon)	18	18	17	16	14	11	14	11	9	10	8	8	40	60	69	50	35	154
Eagle Cr. (Sheep Wash)	18	20	16	20	7	11	12	7	10	9	8	7	40	60	74	37	34	145
East Turkey Cr.	14	17	18	15	14	10	13	12	9	10	9	9	30	70	64	49	37	150
Frye Cr.	20	20	20	18	15	15	13	13	10	10	10	10	40	60	78	56	40	174
Grant Cr. (Blue)	18	13	16	19	10	10	9	10	8	8	8	9	10	90	66	39	33	138
Grant Cr. (Pinaleno)	18	18	16	15	13	14	12	10	8	10	10	9	20	80	67	49	37	153
Lanphier Canyon	18	13	18	16	14	10	12	13	8	9	9	10	30	70	65	49	36	150
Marijilda Cr.	20	18	18	16	15	15	14	12	10	10	8	10	50	50	72	56	38	166
San Francisco R. (Blue)	18	13	11	18	5	9	13	10	7	9	7	4	40	60	60	37	27	124
South Fk Cave Cr.	19	17	16	18	14	13	13	12	9	10	10	10	20	80	70	52	39	161
UPPER SALT BASIN																		
Conklin Cr.	19	19	18	14	13	12	12	14	8	10	10	10	30	70	70	51	38	159
East Fork Black R.	19	19	20	18	7	12	13	13	8	10	9	5	40	60	76	45	32	153
Horton Cr.	20	19	18	16	14	13	11	13	10	10	8	10	25	75	73	51	38	162
N. Fk. Bear Wallow Cr.	20	18	16	19	14	12	13	13	10	10	8	10	50	50	73	52	38	163
Reservation Cr.	19	18	18	15	7	10	10	13	8	10	10	5	10	90	70	40	33	143
West Fork Black R.	18	18	18	16	10	11	12	13	10	10	8	8	30	70	70	46	36	152

Appendix D. Habitat assessment scores for Arizona reference sites sampled in 1992.

SAMPLE SITES - 1992	HABITAT PARAMETERS														TOTAL HABITAT SCORES			
	RIFFLE SUBSTRATE	EMBEDED	POOL SUBSTRATE	VELOCITY/ DEPTH	SHADE CONDITIONS	CHANNEL SHAPE	HABITAT VARIETY	LOWER BANK	UPPER BANK	GRAZING IMPACTS	STREAM COVER	RIPARIAN ZONE	PERCENT POOL	PERCENT RIFFLE	PRIMARY	SECONDARY	TERTIARY	TOTAL
MIDDLE SALT BASIN																		
Campaign Cr.	20	16	15	13	14	14	14	14	9	10	10	10	50	50	64	56	39	159
Canyon Cr.	18	19	18	19	13	10	13	12	9	10	7	8	65	35	74	48	34	156
Cherry Cr. (Lower)	16	17	17	18	13	9	12	9	9	8	8	8	40	60	68	43	33	144
Cherry Cr. (Upper)	15	14	13	13	7	3	8	7	7	6	7	5	70	30	55	25	25	105
Deer Cr.	18	20	16	11	9	13	14	11	7	9	9	10	50	50	65	47	35	147
Greenback Cr.	14	15	13	18	7	9	12	10	7	7	7	7	65	35	60	38	28	126
Haigler Cr.	13	19	18	19	14	9	10	10	9	10	8	8	85	15	69	43	35	147
Reynolds Cr.	19	15	18	17	14	12	13	11	9	9	9	9	60	40	69	50	36	155
Salome Cr.	7	19	16	17	13	9	9	10	8	10	8	8	90	10	59	41	34	134
Spring Cr.	14	16	16	15	13	3	10	9	8	8	7	8	80	20	61	35	31	127
Tonto Cr. (Gisela)	16	17	17	18	7	10	13	9	8	8	5	7	60	40	68	39	28	135
Workman Cr.	18	17	18	17	13	10	12	11	9	10	9	9	65	35	70	46	37	153
SAN PEDRO/WILLCOX BASINS																		
Aravalpa Canyon (East)	10	10	10	12	11	10	7	7	8	10	10	9	10	90	42	35	37	114
Aravalpa Canyon (West)	15	15	12	15	13	13	14	9	10	10	10	9	20	80	57	49	39	145
Bass Canyon	20	20	16	17	13	15	14	10	9	10	9	10	50	50	73	52	38	163
Goudy Cr.	18	16	15	16	13	14	13	11	9	9	10	8	50	50	65	51	36	152
Hot Springs Canyon	18	20	16	13	10	8	10	10	7	10	8	10	20	80	67	38	35	140
Ramsey Canyon	19	19	20	18	14	12	13	13	9	10	9	9	30	70	76	52	37	165
Redfield Canyon	18	20	16	16	11	11	13	10	10	10	9	9	40	60	70	45	38	153
San Pedro R.	13	12	11	13	10	10	13	9	2	9	2	6	50	50	49	42	19	110
Ward Canyon	17	18	16	15	14	12	11	13	8	9	6	6	15	85	66	50	29	145
SANTA CRUZ BASIN																		
Canada del Oro Cr.	16	15	16	17	14	10	13	13	9	8	9	9	65	35	64	50	35	149
Cave Cr.	18	17	16	18	14	10	13	13	8	9	8	8	40	60	69	50	33	152
Cienega Cr.	13	18	15	16	12	9	9	10	7	9	9	9	30	70	62	40	34	136
Gardner Cr.	17	16	17	16	13	9	12	13	8	9	9	9	25	75	66	47	35	148
Madera Cr.	18	17	18	17	14	12	13	13	9	10	9	9	55	45	70	52	37	159
Sabino Cr.	18	19	18	17	14	12	13	11	9	10	9	9	70	30	72	50	37	159
Santa Cruz R.	9	9	10	10	7	3	7	10	5	7	8	8	15	85	38	27	28	93
RIO DE MEXICO BASINS																		
Rucker Cr.	18	18	17	18	13	13	12	11	9	9	7	8	30	70	71	49	33	153
Sycamore Cr. (Sonora)	16	15	15	14	13	10	9	10	8	10	9	8	25	75	60	42	35	137

Appendix D. Habitat assessment scores for Arizona reference sites sampled in 1992.

SAMPLE SITES - 1992	HABITAT PARAMETERS														TOTAL HABITAT SCORES			
	RIFFLE SUBSTRATE	EMBEDED.	POOL SUBSTRATE	VELOCITY/ DEPTH	SHADE CONDITIONS	CHANNEL SHAPE	HABITAT VARIETY	LOWER BANK	UPPER BANK	GRAZING IMPACTS	STREAM COVER	RIPARIAN ZONE	PERCENT POOL	PERCENT RIFFLE	PRIMARY	SECONDARY	TERTIARY	TOTAL
VERDE BASIN																		
Black Canyon	15	16	15	15	13	10	12	10	8	8	8	8	15	85	61	45	32	138
East Verde R. (Brushy Canyon)	18	16	12	18	11	14	12	11	9	10	8	6	70	30	64	48	33	145
East Verde R. (Ellison)	18	17	20	18	12	15	15	12	10	10	8	10	60	40	73	54	38	165
Oak Cr. (Baldwin Crossing)	18	18	16	18	6	13	14	11	8	7	9	8	60	40	70	44	32	146
Oak Cr. (Chavez Crossing)	18	15	11	16	11	11	14	10	8	9	7	8	60	40	60	46	32	138
Oak Cr. (Grasshopper Pt.)	18	16	16	18	12	11	13	10	8	9	8	8	40	60	68	46	33	147
Oak Cr. (Pine Flat)	18	16	18	14	12	12	13	11	10	10	10	10	80	20	66	48	40	154
Oak Cr. (Red Rock)	14	15	14	13	7	11	13	12	9	10	10	8	50	50	56	43	37	136
Pine Cr.	16	16	16	15	10	10	12	10	8	8	8	7	40	60	65	42	31	138
Roundtree Cr.	15	18	18	15	13	12	12	11	8	9	9	9	70	30	66	48	35	149
Sycamore Cr. (Horseshoe)	17	16	15	14	11	15	13	11	9	9	10	10	65	35	62	50	38	150
Sycamore Cr. (Mazatzal)	17	13	12	15	10	11	12	10	8	8	8	7	60	40	57	43	31	131
Verde R. (Perkinsville)	18	15	10	18	11	11	11	11	5	8	9	8	40	60	61	44	30	135
Webber Cr.	20	18	16	18	15	12	12	14	10	10	9	10	35	65	72	53	39	164
West Clear Cr. (Lower)	18	18	18	18	12	13	13	10	9	10	10	10	50	50	72	48	39	159
West Clear Cr. (Upper)	18	18	20	18	11	15	13	11	10	10	10	10	70	30	74	50	40	164
West Fork Oak Cr.	11	18	12	12	14	10	13	13	10	10	10	10	80	20	53	50	40	143
Wet Beaver Cr.	20	19	16	19	15	15	15	11	10	10	10	10	60	40	74	56	40	170
MIDDLE GILA BASIN																		
Agua Fria R.	15	14	17	16	8	4	9	9	7	7	5	7	70	30	62	30	26	118
Antelope Cr.	14	15	16	17	9	8	13	12	9	9	5	9	60	40	62	42	32	136
Ash Cr.	17	17	18	15	14	12	12	11	9	9	9	8	65	35	67	49	35	151
Hassayampa R. (Upper)	15	14	14	16	10	3	10	10	8	8	8	7	20	80	59	33	31	123
Lion Canyon	13	12	18	15	10	8	7	10	8	9	9	8	85	15	58	35	34	127
Little Ash Cr.	15	14	17	16	13	3	11	10	8	8	7	8	60	40	62	37	31	130
Poland Cr.	13	12	16	17	9	9	7	8	8	9	9	9	85	15	58	33	35	126
Sycamore Cr. (Dugas)	16	14	17	16	12	5	12	10	8	9	9	8	75	25	63	39	34	136
BILL WILLIAMS BASIN																		
Burro Cr.	15	16	17	16	10	9	12	10	9	9	9	8	65	35	64	41	35	140
Conger Cr.	18	18	19	16	12	12	13	13	9	10	8	9	60	40	71	50	36	157
Francis Cr.	18	17	16	18	13	10	13	11	8	9	9	8	60	40	69	47	34	150
Peeples Canyon	16	15	15	17	14	12	12	11	9	10	10	9	80	20	63	49	38	150
Santa Maria R.	8	7	7	9	5	3	3	7	5	2	4	2	90	10	31	18	13	62
Trout Cr.	17	16	17	18	11	12	12	7	8	9	9	8	75	25	68	42	34	144
NORTHERN COLORADO MAINSTEM																		
Bright Angel Cr.	16	13	18	9	8	11	3	10	2	9	9	5	5	99	56	32	25	113
Havasu Cr.	11	5	10	15	8	11	12	8	6	9	9	6	80	20	41	39	30	110
Hermit Cr.	18	18	10	13	9	10	10	7	4	5	9	5	10	90	59	36	23	118
Kanab Cr.	18	15	9	20	9	11	9	7	5	9	4	6	50	50	62	36	24	122
Matkatamiba Cr.	15	15	14	15	9	10	12	7	6	5	2	1	20	80	59	38	14	111
Nankoweap Cr.	15	12	10	2	7	2	3	7	5	6	4	8	0	100	39	19	23	81
Paria R.	8	8	1	13	13	2	9	14	1	10	4	4	20	80	30	38	19	87
Royal Arch Cr.	15	5	12	16	11	11	11	9	6	8	5	7	50	50	48	42	26	116
Spring Canyon	19	13	16	15	15	10	10	10	9	10	10	10	5	95	63	45	39	147
Tapeats Cr.	20	20	0	10	8	12	0	11	10	10	5	8	0	100	50	31	33	114

APPENDIX E.

Relative abundances of macroinvertebrate taxa collected by kick net method from reference site streams in Arizona, 1992. (Data presented are combined and weighted pool plus riffle abundances and are untransformed.)

(E1 - E60)

[redacted]oin[redacted]ebra[redacted]bur[redacted]ces [redacted]efer[redacted] Sit[redacted]n Ar[redacted]a, 1[redacted] (Co[redacted]ed [redacted]+P[redacted], untr[redacted]ed data)

Taxonomic name	Species Code	Bill Williams Basin						Little Colorado River Basin								
		BUR1	CGR1	FRA1	PEE1	SMR1	TRT1	BAR2	BAR1	CHV2	CHV3	CHV4	ECL1	ECL2	ELC1	LCR1
Hydra	HYDRAAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria	TURBELL	0.0	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	1.2	0.0	0.0
Nematoda	NEMATOM	0.0	1.6	9.6	0.0	0.0	6.0	82.0	0.0	0.0	0.0	0.0	1.6	5.6	35.2	6.4
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	0.0	9.6	22.4	0.0	0.0	6.0	22.0	0.0	0.0	0.0	0.0	3.2	156.8	19.2	17.6
Erpobdella	ERPOBDL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossiphonia complanata	GLOSCOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106.4	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4	0.0	0.0
Pisidium	PISIDUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.3	1.8	0.0	0.0	65.6	41.2	22.4	0.0
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.8	184.8	0.0	0.0
Physella	PHYSELL	0.0	79.2	566.4	38.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	99.2	1.2	24.0	0.0
Gyraulus	GYRAULS	0.0	0.0	153.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	0.0	192.0	19.2	0.0	14.8	6.0	3.2	0.7	3.0	0.5	0.0	9.6	50.4	4.8	22.4
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	77.6	0.0	0.0	0.0	0.0	0.0	2.8	1.2	12.0	12.0	0.0	0.0	0.0	0.0
Orconectes causeyi	ORCONEC	0.0	0.0	0.0	0.0	0.0	0.0	3.6	47.6	33.1	42.5	38.0	32.8	0.0	0.0	0.0
Acari	ACARIII	320.8	21.6	576.0	250.8	159.6	323.0	26.0	26.4	0.6	1.5	0.0	8.0	144.8	51.2	27.2
Order - Odonata																
Aeshnidae-early instar	AESHNID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordulegaster	CORDULG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gomphidae	GOMPHID	10.4	0.0	0.0	0.4	22.0	1.0	0.0	4.8	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Libellulidae	LIBELLU	0.0	36.8	211.2	250.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calopterygidae	CALOPTR	0.0	44.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coenagrionidae	COENAGR	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Argia	ARGIAAA	52.0	64.8	528.0	111.2	0.0	0.0	0.0	13.5	6.0	0.0	0.0	6.4	5.6	0.0	0.0
Enallagma/Ischnura	ENALLAG	0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	5.6	0.0	0.0
Lestidae	LESTIDE	0.0	122.4	0.0	51.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Ephemeroptera																
Baetidae	BAETIDE	1313.2	336.8	2032.0	406.4	369.6	703.0	189.2	46.0	107.2	4.5	0.0	804.8	174.8	105.6	766.4
Baetodes	BAETODS	11.2	14.4	0.0	0.0	1.2	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Caenis	CAENISS	10.4	436.8	9.6	307.2	0.0	12.0	25.6	419.0	0.0	0.5	0.0	297.6	258.8	0.0	0.0
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.6	0.0
Ephemerella	EPHEMER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.4
Serratella micheneri	SERRATL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epeorus	EPEORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0
Heptagenia/Nixe	HEPTAGN	0.0	0.0	0.0	0.0	0.0	0.0	90.0	135.4	28.4	0.0	0.0	4.8	0.0	64.0	52.8

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Bill Williams Basin						Little Colorado River Basin								
		BUR1	CGR1	FRA1	PEE1	SMR1	TRT1	BAR2	BAR1	CHV2	CHV3	CHV4	ECL1	ECL2	ELC1	LCR1
Rhithrogena	RHITHRG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.0	0.0	0.0	0.0	553.6	141.4	17.3	0.0	0.0	0.0	0.0	0.0	9.6
Choroterpes/Thraulodes	CHORTHR	58.8	161.6	38.4	394.4	178.4	170.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0
Paraleptophlebia	PARALEP	0.0	0.0	12.8	0.0	0.0	0.0	1.2	12.0	0.0	0.0	0.0	0.0	0.0	152.0	0.0
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	ISONYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameletus	AMELETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siphlonurus	SIPHLON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptohyphes	LEPTHYP	18.8	57.6	588.8	25.6	2614.4	98.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0
Tricorythodes	TRICORY	3715.2	116.0	2563.2	1969.6	173.2	1570.0	9.6	122.4	0.0	0.0	0.0	38.4	292.4	11.2	27.2
Order - Plecoptera																
Capniidae	CAPNIID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chloroperlidae	CHLRPER	0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amphinemura	AMPHINM	0.0	0.0	0.0	0.0	0.0	0.0	2.4	98.4	10.8	0.0	0.0	1.6	0.0	390.4	115.2
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	PERLODN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.4
Isoperla	ISOPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8
Taeniopterygidae	TAENIOP	0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Hemiptera																
Belastomatidae	BELOSTM	0.0	4.8	0.0	14.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abedus	ABEDUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corixidae	CORIXID	0.0	14.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambrysus	AMBRYSU	8.4	12.0	121.6	0.0	8.4	0.0	0.0	43.2	0.0	0.0	0.0	20.8	4.8	0.0	0.0
Notonectidae	NOTONEC	0.0	4.8	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera																
Corydalus cornutus	CORYCOR	0.0	1.6	0.0	12.8	8.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neohermes filicornis	NEOHERM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Trichoptera																
Brachycentrus	BRACHYC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micrasema	MICRASM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	182.4	0.0
Phylloicus	PHYLLOI	0.0	134.4	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agapetus	AGAPETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.6
Culoptila	CULOPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossosoma	GLOSSOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	6.4	0.0
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	0.0	1.6	0.0	0.0	8.0	0.0	0.0	12.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0
Atopsyche	ATPSYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	1.8	1.0	0.0	0.0	0.0	19.2	0.0
Cheumatopsyche	CHEUMAT	490.4	116.8	150.4	28.8	16.0	77.0	0.0	19.2	5.1	9.5	0.0	41.6	73.2	0.0	0.0
Hydropsyche	HYDROPS	117.6	11.2	256.0	0.0	0.0	68.0	0.0	13.4	0.0	4.0	0.0	116.8	78.0	99.2	168.0
Leptonema	LEPTONM	0.0	4.8	1254.4	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptilidae-early instar	HYDTILD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
Hydroptila	HYDTILA	0.0	104.8	89.6	1.2	165.6	0.0	3.6	0.0	0.0	0.0	0.0	0.0	16.8	0.0	0.0
Ithytrichia	ITHYTRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0
Leucotrichia	LEUCOTR	0.0	1.6	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mayatrichia	MAYATRI	8.4	11.2	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neotrichia	NEOTRIC	0.0	4.8	0.0	13.6	0.0	18.0	0.0	0.0	1.2	0.0	0.0	3.2	0.0	41.6	0.0
Ochrotrichia	OCHROTR	522.4	25.6	64.0	26.0	8.0	0.0	0.8	0.0	0.0	0.0	0.0	1.6	12.4	30.4	76.8

Macroinvertebrate Abundances at Reference Sites in Arizona, 1990 (Combined Riffle + Random Uniform Data)

Taxonomic name	Species Code	Bill Williams Basin						Little Colorado River Basin								
		BUR1	CGR1	FRA1	PEE1	SMR1	TRT1	BAR2	BAR1	CHV2	CHV3	CHV4	ECL1	ECL2	ELC1	LCR1
Oxyethira	OXYETHR	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-turret case	LEPTURR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	75.2	0.0
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	0.0	105.6	441.6	0.0	0.0	54.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Oecetis	OECETIS	0.0	33.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	HESPERO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilus	LIMPHIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0
Marilia	MARILIA	0.0	0.0	0.0	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chimarra	CHIMARR	78.4	199.2	179.2	4.0	12.8	22.0	0.0	0.0	0.0	0.0	0.0	27.2	15.6	0.0	0.0
Wormaldia	WORMALD	0.0	12.8	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	POLYCEN	0.0	40.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polyplectropus	POLYPLE	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	GUMAGAA	0.0	0.0	0.0	0.0	1.2	0.0	0.0	40.8	0.0	0.0	0.0	0.0	0.0	6.4	0.0
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera																
Petrophila	PETROPH	0.0	3.2	9.6	0.0	0.8	0.0	0.0	0.0	0.0	2.5	0.0	4.8	1.2	0.0	4.8
Order - Coleoptera																
Dytiscidae	DYTISCD	0.0	12.0	0.0	180.8	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Postelichus	POSTELS	0.0	0.0	9.6	25.6	14.8	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cleptelmis	CLEPTEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.6	0.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	0.0	144.0	0.0	0.0	24.0	0.4	0.0	0.0	0.0	0.0	537.6	173.6	0.0	0.0
Heterelmis	HETRLMN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	MACRELM	0.0	44.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	25.6	35.6	0.0	0.0
Microcylloepus	MICYLEP	11.2	24.0	675.2	0.4	1.2	53.0	0.0	0.7	0.6	0.0	0.0	134.4	22.8	0.0	0.0
Narpus	NARPUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neocylloepus	NEOCYLL	0.0	14.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neoelmis	NEOELMS	2.8	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Optioservus	OPTIOSR	0.0	0.0	0.0	0.4	0.0	0.0	0.0	28.8	0.5	0.0	0.0	0.0	0.0	499.2	180.8
Xenelmis	XENELMS	0.0	0.0	0.0	0.4	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	ZAITZEV	0.0	0.0	0.0	0.0	0.4	0.0	0.0	7.2	0.6	0.0	0.0	4.8	0.0	6.4	28.8
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Bill Williams Basin						Little Colorado River Basin								
		BUR1	CGR1	FRA1	PEE1	SMR1	TRT1	BAR2	BAR1	CHV2	CHV3	CHV4	ECL1	ECL2	ELC1	LCR1
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	GYRINUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	0.0	0.0	28.8	79.2	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrophilidae other	HYDPHIL	0.0	0.0	0.0	204.8	0.0	0.0	9.6	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Berosus	BEROSUS	0.0	0.0	0.0	51.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Tropisternus	TROPIST	0.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	0.0	0.0	12.8	0.4	0.8	6.0	0.0	4.9	13.2	5.5	0.0	0.0	0.0	0.0	0.0
Order - Diptera																
Atherix	ATHERIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopoginidae	CERTPGD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	CERTPGN	760.0	22.4	582.4	550.4	124.4	113.0	58.8	20.3	3.0	0.0	0.0	12.8	44.8	27.2	11.2
Forcipomyiinae	FORCIPO	0.0	4.8	0.0	13.6	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Dixa	DIXAAAA	0.0	0.0	0.0	0.0	0.0	0.0	6.8	2.4	0.0	0.0	0.0	0.0	0.0	8.0	0.0
Dixella	DIXELLA	0.0	5.6	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0
Meringodixa	MERINGO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	0.0	0.4	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chelifera	CHELIFR	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	38.4	4.8
Clinocera	CLINOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	1.5	0.0	1.6	0.0	12.8	0.0
Hemerodromia	HEMEROD	5.6	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Ephydridae	EPHYDRI	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	MARUINA	0.0	46.4	60.8	14.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pericoma	PERICOM	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	SIMULII	144.8	168.8	112.0	12.4	0.4	7.0	100.8	77.0	84.2	8.5	0.0	92.8	30.0	1264.0	110.4
Stratiomyiidae	STRATIO	0.0	5.6	9.6	81.2	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syrphidae	SYRPHID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	10.4	0.0	48.0	43.6	0.0	3.0	0.0	0.0	0.0	0.0	0.0	3.2	1.2	1.6	4.8
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antocha	ANTOCHA	0.0	4.8	12.8	0.0	0.0	0.0	0.0	1.4	2.5	1.0	0.0	0.0	0.0	6.4	14.4
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	28.8	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicranota	DICRANO	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	1.0	0.5	0.0	6.4	2.4	14.4	0.0
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoconopa	HESPCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	0.0	0.0	0.0	425.6	43.6	0.0	0.0	43.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holorusia	HOLORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	6.4	0.0
Molophilus	MOLOPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	TIPULAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	9.6

[redacted]oin[redacted]bra[redacted]bun[redacted]es [redacted]efer[redacted] Sit[redacted] Ari[redacted], 19[redacted] (Co[redacted]ed [redacted]+P[redacted], untr[redacted]ata)[redacted]

Taxonomic name	Species Code	Bill Williams Basin						Little Colorado River Basin								
		BUR1	CGR1	FRA1	PEE1	SMR1	TRT1	BAR2	BAR1	CHV2	CHV3	CHV4	ECL1	ECL2	ELC1	LCR1
Family - Chironomidae																
Ablabesmyia	ABLABES	0.0	8.4	0.0	0.0	65.2	6.0	28.8	0.0	0.0	0.0	0.0	9.6	252.0	0.0	0.0
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	ALOTANY	0.0	37.8	12.8	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	1.6	0.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	APEDILU	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.0	0.0	0.0	0.0	0.0	0.0	0.4	2.4	0.0	0.0	0.0	0.0	0.0	21.6	0.0
Brundiniella	BRUNDIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryophaenocladius	BRYOPHN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	0.0	0.0	0.0	0.0	1.6	0.0	0.0	1.4	0.6	0.0	0.0	0.0	1.2	1.6	0.0
Chaetocladius	CHAETOC	0.0	0.0	0.0	0.8	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	0.0	24.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.8	0.0	0.0
Conchapelopia	CONCHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	31.2	43.8	25.6	13.6	143.2	25.0	36.4	62.5	11.7	0.0	0.0	1.6	22.4	63.2	0.0
Constempellina	CONSTMP	0.0	0.0	0.0	102.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corynoneura	CORYNON	0.0	18.6	0.0	25.6	1.6	0.0	0.4	9.6	0.6	0.0	0.0	3.2	1.2	16.8	0.0
Cricotopus	CRICOTP	120.0	5.2	246.4	0.0	19.6	60.0	30.4	6.9	1.5	0.0	0.0	8.0	126.8	122.4	0.0
Cricotopus (Nostococladius)	CRICNOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptochironomus	CRYPCHR	0.0	0.0	0.0	0.0	22.4	6.0	14.4	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	0.0	0.0	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicrotendipes	DICRTND	0.0	0.0	9.6	12.8	139.2	30.0	0.0	0.0	0.0	0.0	0.0	6.4	190.4	0.0	0.0
Djalmabatista	DJALMAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	5.6	4.2	92.8	0.4	2.0	17.0	64.8	30.9	37.1	3.0	0.0	68.8	32.4	1097.6	0.0
Eukiefferiella/Thienemanniella	EUKTHIE	110.8	20.8	345.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella	EUKIELL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Heterotrissocladius	HETRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labrundinia	LABRUND	52.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Larsia	LARSIAA	0.0	0.0	0.0	25.6	7.2	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0
Lauterborniella	LAUTERB	84.0	0.0	12.8	38.8	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lopescladius	LOPESCL	0.0	0.0	0.0	0.0	7.6	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Lopescladius	NRLOPES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	0.0	0.0	0.0	0.0	0.0	0.0	43.2	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0
nr. Mesocricotopus	MESCRIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	1.6	0.0	0.0	0.0
Micropsectra	MICROPS	0.0	8.4	115.2	0.0	0.0	0.0	7.2	7.2	0.0	0.0	0.0	0.0	61.6	0.0	0.0
Microtendipes	MICRTEN	0.0	0.0	0.0	0.0	0.0	0.0	7.2	4.8	0.0	0.0	0.0	19.2	72.8	0.0	0.0
Nanocladius	NANCLDS	10.4	0.0	96.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Nilotanypus	NILOTAN	2.8	5.2	0.0	104.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nilothauma	NILOTHA	0.0	0.0	9.6	12.8	23.2	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Bill Williams Basin						Little Colorado River Basin								
		BUR1	CGR1	FRA1	PEE1	SMR1	TRT1	BAR2	BAR1	CHV2	CHV3	CHV4	ECL1	ECL2	ELC1	LCR1
Orthocladiinae-unknown genus	ORTHCLU	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.2	0.0
Orthocladius complex	ORTHCL1	25.2	0.0	44.8	0.0	0.8	1.0	32.8	14.1	1.5	1.0	1.0	3.2	24.4	17.6	0.0
Orthocladius (Orthocladius)	ORTHCLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	0.0	0.0	0.0	0.0	0.4	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	34.4	0.0
Pagastia	PAGASTI	0.0	0.0	0.0	0.0	0.0	0.0	1.2	4.8	3.6	0.0	0.0	1.6	0.0	377.6	0.0
Parachaetocladius	PRCHAET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Parachaetocladius	NRPRCHT	0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	20.8	0.0	0.0	0.0	0.0	24.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parakiefferiella	PRKIEFF	0.0	0.0	0.0	0.0	0.0	3.0	7.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	0.0	25.2	172.8	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parametriocnemus	PRMETRI	0.0	0.0	0.0	0.0	0.0	2.0	37.6	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0
Paraphaenocladius	PRPHAEN	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratanytarsus	PRTANYT	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	22.4	4.2	0.0	0.0	89.2	8.0	0.0	12.0	0.0	0.0	0.0	0.0	61.6	0.0	0.0
Parochlus kiefferi	PARKIEF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pentaneura cf. inconspicua	PENTINC	0.0	0.0	0.0	25.6	5.2	1.0	27.6	0.0	0.0	0.0	0.0	12.8	17.6	0.0	0.0
Pentaneura n. sp.	PENTANN	5.6	0.0	0.0	2.8	9.2	0.0	0.8	2.4	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Phaenopsectra	PHAENOP	0.0	16.8	0.0	0.0	0.0	6.0	21.6	0.0	0.0	0.0	0.0	0.0	28.0	0.0	0.0
Polypedilum	POLYPED	58.4	842.8	86.4	88.8	157.2	49.8	57.6	0.7	8.9	0.5	0.0	38.4	106.8	6.4	0.0
Potthastia	POTTHST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Procladius	PROCLAD	0.0	0.0	0.0	0.0	0.0	6.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prodiamesa	PRODIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	131.2	0.0	0.0
Pseudochironomus	PSDCHIR	207.2	21.0	41.6	230.4	167.2	12.0	0.0	0.0	0.0	0.0	0.0	0.0	162.4	0.0	0.0
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosmittia	PSDSMIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psilometriocnemus	PSDMETR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheocricotopus	RHEOCRC	0.0	14.4	0.0	0.0	0.4	5.0	0.8	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0
Rheopelopia	RHEOPEL	2.8	5.2	0.0	0.4	0.0	0.0	0.0	2.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Rheotanytarsus	RHEOTAN	2.8	0.0	92.8	0.0	6.0	2.0	1.6	0.0	0.0	0.0	0.0	1.6	68.4	16.8	0.0
Robackia	ROBACKI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Robackia	NROBACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saetheria	SAETHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smittia	SMITTIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	STEMPEL	0.0	46.2	0.0	0.0	0.0	0.0	123.2	0.0	0.0	0.0	0.0	12.8	47.2	8.8	0.0
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	52.0	281.4	0.0	103.6	0.0	36.0	0.0	6.9	0.5	10.0	10.0	0.0	0.0	0.0	0.0
Stilocladius	STILOCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Synorthocladius	SYNORTH	0.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
Tanytarsus	TANYTAR	81.2	56.4	192.0	0.0	0.0	1.0	7.6	2.4	0.0	0.0	0.0	0.0	166.0	6.4	0.0
Telopelopia okoboji	TELOPOK	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	THIENEL	0.0	0.0	262.4	0.4	29.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	0.0	0.0	0.0	0.0	7.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tvetenia	TVETENI	10.4	0.0	12.8	0.0	0.0	0.0	0.4	9.6	6.0	0.0	0.0	1.6	0.0	20.0	0.0
Xestochironomus	XESTCHR	0.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	57.6	0.0	12.8	154.0	14.4	18.0	36.0	9.3	0.0	0.0	0.0	16.0	0.0	11.2	0.0

[redacted]oin[redacted]bra[redacted]oun[redacted]ces [redacted]fer[redacted] Sit[redacted] Ari[redacted], 19[redacted] (Co[redacted]ed, [redacted] + P[redacted], untransformed data)

Taxonomic name	Species Code	Little Colorado River Basin										
		LCR9	LCR3	LCR2	LIL1	MAM1	MIN1	PAD1	RUD1	SLC1	WLC1	WLC2
Hydra	HYDRAAA	0.0	0.0	0.0	0.3	0.0	0.0	0.0	6.0	0.0	0.0	0.0
Turbellaria	TURBELL	0.0	0.0	0.0	12.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nematoda	NEMATOM	0.0	0.0	0.0	0.3	0.0	3.0	0.0	13.0	0.0	6.4	0.0
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	0.1	34.4	0.0	88.8	18.7	19.0	8.8	16.0	0.0	11.2	1.0
Erpobdella	ERPOBDL	0.0	0.0	0.0	0.0	0.0	7.4	0.0	0.0	27.0	0.0	0.0
Glossiphonia complanata	GLOSCOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pisidium	PISIDUM	0.0	0.0	2.4	10.4	7.5	88.4	1.6	63.0	1.0	8.0	311.0
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Physella	PHYSELL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyraulus	GYRAULS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	0.0	0.0	0.3	0.3	90.5	33.0	4.0	1.0	16.0	0.0	7.0
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	7.2	0.3	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Orconectes causeyi	ORCONEC	0.0	19.6	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acari	ACARIII	0.0	13.6	31.8	9.8	12.7	77.8	88.0	97.0	97.0	282.4	555.0
Order - Odonata												
Aeshnidae-early instar	AESHNID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Cordulegaster	CORDULG	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.0	0.0	0.0	0.0
Gomphidae	GOMPHID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Libellulidae	LIBELLU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calopterygidae	CALOPTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coenagrionidae	COENAGR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Argia	ARGIAAA	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Enallagma/Ischnura	ENALLAG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lestidae	LESTIDE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Ephemeroptera												
Baetidae	BAETIDE	0.3	2675.2	452.7	35.7	69.3	229.0	419.2	752.0	926.0	958.4	299.0
Baetodes	BAETODS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caenis	CAENISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.0	86.0	44.8	1.0
Ephemerella	EPHEMER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	6.4	0.0
Serratella micheneri	SERRATL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	0.0	0.0	4.5	53.6	0.0	59.2	0.0	7.0	120.8	0.0
Epeorus	EPEORUS	0.0	0.0	0.0	1.4	24.5	11.8	57.6	0.0	54.0	277.6	42.0
Heptagenia/Nixe	HEPTAGN	0.0	6.8	23.7	0.0	0.0	10.4	0.0	212.0	989.0	0.0	1.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Little Colorado River Basin										
		LCR9	LCR3	LCR2	LIL1	MAM1	MIN1	PAD1	RUD1	SLC1	WLC1	WLC2
Rhithrogena	RHITHRG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Choroterpes/Thraulodes	CHORTHR	0.0	122.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paraleptophlebia	PARALEP	0.0	0.0	4.8	0.0	0.0	116.8	0.0	267.0	263.0	3.2	1.0
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	ISONYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameletus	AMELETS	0.0	0.0	0.0	22.5	3.1	0.0	8.8	0.0	0.0	1.6	2.0
Siphlonurus	SIPHLON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.0	0.0	0.0	0.0
Leptohyphes	LEPTHYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tricorythodes	TRICORY	0.0	37.6	13.8	0.0	0.0	1.2	0.0	0.0	13.0	0.0	0.0
Order - Plecoptera												
Capniidae	CAPNIID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chloroperlidae	CHLRPER	0.0	0.0	0.0	5.6	20.9	1.2	48.0	0.0	3.0	82.4	14.0
Amphinemura	AMPHINM	0.0	0.0	19.2	179.1	2.0	98.6	11.2	98.0	482.0	135.2	109.0
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	9.4	0.0	18.4	0.0	0.0	0.0	6.0
Perlodinae	PERLODN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.0	0.0	0.0
Isoperla	ISOPERL	0.0	0.0	81.9	3.7	0.8	0.0	0.0	37.0	0.0	0.0	0.0
Taeniopterygidae	TAENIOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Hemiptera												
Belastomatidae	BELOSTM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abedus	ABEDUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corixidae	CORIXID	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambrysus	AMBRYSU	0.0	0.0	7.5	0.0	0.0	9.0	0.0	24.0	44.0	0.0	0.0
Notonectidae	NOTONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera												
Corydalus cornutus	CORYCOR	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neohermes filicornis	NEOHERM	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Order - Trichoptera												
Brachycentrus	BRACHYC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0
Micrasema	MICRASM	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.8	0.0
Phylloicus	PHYLLOI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agapetus	AGAPETS	0.0	0.0	9.6	0.0	0.0	0.0	0.0	32.0	6.0	0.0	1.0
Culoptila	CULOPTL	0.0	0.0	0.0	0.0	0.0	23.6	0.0	0.0	0.0	0.0	0.0
Glossosoma	GLOSSOS	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Atopsyche	ATPSYCH	0.0	0.0	0.0	0.0	0.0	6.2	0.0	60.0	0.0	0.0	6.0
Cheumatopsyche	CHEUMAT	0.0	88.4	4.8	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0
Hydropsyche	HYDROPS	0.0	299.6	46.5	32.5	17.5	14.0	12.8	24.0	181.0	12.8	0.0
Leptonema	LEPTONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptilidae-early instar	HYDTILD	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Hydroptila	HYDTILA	0.0	40.8	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0
Ithytrichia	ITHYTRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leucotrichia	LEUCOTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mayatrichia	MAYATRI	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neotrichia	NEOTRIC	0.0	0.0	7.2	0.0	0.0	0.0	0.0	27.0	42.0	0.0	0.0
Ochrotrichia	OCHROTR	0.0	224.8	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0

[redacted]oin[redacted]bra[redacted]bun[redacted]es [redacted]fere[redacted] Site[redacted] Ari[redacted], 19[redacted] (Com[redacted]ed [redacted]+ P[redacted], untra[redacted]ormed data)

Taxonomic name	Species Code	Little Colorado River Basin										
		LCR9	LCR3	LCR2	LIL1	MAM1	MIN1	PAD1	RUD1	SLC1	WLC1	WLC2
Oxyethira	OXYETHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	0.0	0.0	42.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	0.0	0.0	0.0	2.4	0.6	1.6	0.0	0.0	82.4	1007.0
Lepidostoma-turret case	LEPTURR	0.0	0.0	0.3	11.9	8.3	14.4	17.6	4.0	3.0	0.8	0.0
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oecetis	OECETIS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0
Hesperophylax	HESPERO	0.0	0.0	0.0	9.4	1.8	9.0	0.0	24.0	0.0	0.0	0.0
Limnephilus	LIMPHIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	0.0	8.1	0.0	1.6	2.0	0.0	3.2	0.0
Marilia	MARILIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chimarra	CHIMARR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wormaldia	WORMALD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	POLYCEN	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	6.0	0.0	0.0
Polyplectropus	POLYPLE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	32.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	GUMAGAA	0.0	0.0	0.0	0.0	0.0	19.8	0.0	33.0	5.0	0.0	0.0
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	6.0
Order - Lepidoptera												
Petrophila	PETROPH	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Coleoptera												
Dytiscidae	DYTISCD	0.0	0.0	0.0	0.3	0.0	0.0	0.0	6.0	0.0	0.0	0.0
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	0.0	0.0	0.0	0.9	1.8	0.0	0.0	6.0	0.0	0.0	0.0
Postelichus	POSTELS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cleptelmis	CLEPTEL	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	9.6	127.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterelmis	HETRLMN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	MACRELM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microcylloepus	MICYLEP	0.0	28.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Narpus	NARPUSS	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	8.0	6.4	7.0
Neocylloepus	NEOCYLL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neoelmis	NEOELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Optioservus	OPTIOSR	0.0	0.4	45.9	4.7	321.0	688.6	332.8	668.0	228.0	65.6	68.0
Xenelmis	XENELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	ZAITZEV	0.0	0.0	56.1	0.0	4.8	23.6	70.4	222.0	360.0	0.0	15.0
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Little Colorado River Basin										
		LCR9	LCR3	LCR2	LIL1	MAM1	MIN1	PAD1	RUD1	SLC1	WLC1	WLC2
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	GYRINUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrophilidae other	HYDPHIL	0.0	0.0	0.0	3.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Berosus	BEROSUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0
Tropisternus	TROPIST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	43.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Order - Diptera												
Atherix	ATHERIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	39.0
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopoginidae	CERTPGD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	CERTPGN	0.1	0.4	6.6	13.7	13.2	7.8	14.4	28.0	4.0	1.6	1.0
Forcipomyiinae	FORCIPO	0.0	0.0	0.0	1.4	0.0	8.4	0.0	7.0	0.0	0.0	0.0
Dixa	DIXAAAA	0.0	0.0	0.0	0.0	0.0	2.8	0.0	4.0	0.0	0.0	0.0
Dixella	DIXELLA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Meringodixa	MERINGO	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	6.0	0.0	0.0
Chelifera	CHELIFR	0.0	0.0	2.7	0.3	1.8	18.0	1.6	6.0	0.0	0.0	0.0
Clinocera	CLINOCR	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Hemerodromia	HEMEROD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ephydridae	EPHYDRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	MARUINA	0.0	0.0	0.0	0.0	1.8	0.0	1.6	0.0	12.0	0.0	0.0
Pericoma	PERICOM	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.8	0.0
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.9	0.0	0.8	34.0	0.0	0.0	0.0
Simuliidae	SIMULII	2.2	90.4	155.4	10.1	2.3	218.2	24.0	45.0	3581.0	5176.0	821.0
Stratiomyiidae	STRATIO	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Syrphidae	SYRPHID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antocha	ANTOCHA	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	7.0	0.0	1.0
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicranota	DICRANO	0.0	6.8	0.0	8.2	4.3	48.2	0.8	30.0	0.0	4.0	0.0
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoconopa	HESPCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	0.0	0.0	0.0	0.3	3.9	3.0	9.6	5.0	37.0	2.4	13.0
Holorusia	HOLORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Molophilus	MOLOPHL	0.0	0.0	0.0	4.2	0.1	0.0	0.0	6.0	0.0	0.0	0.0
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	TIPULAA	0.0	0.0	5.1	9.4	0.1	0.0	0.0	5.0	6.0	0.0	1.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 19[illegible] (Combined [illegible] + Paunt[illegible]orm[illegible] data)

Taxonomic name	Species Code	Little Colorado River Basin										
		LCR9	LCR3	LCR2	LIL1	MAM1	MIN1	PAD1	RUD1	SLC1	WLC1	WLC2
Family - Chironomidae												
Ablabesmyia	ABLABES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	ALOTANY	0.0	0.0	0.0	0.0	0.0	28.6	4.0	0.0	0.0	3.2	6.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	APEDILU	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.0	0.0	0.0	0.0	0.3	3.4	0.0	3.0	0.0	0.8	0.0
Brundiniella	BRUNDIN	0.0	0.0	0.0	32.0	15.3	0.0	0.0	56.0	0.0	6.4	0.0
Bryophaenocladius	BRYOPHN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	12.0
Chaetocladius	CHAETOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia	CONCHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	0.0	7.2	1.2	0.0	0.0	3.4	3.2	21.0	8.0	28.0	6.0
Constempellina	CONSTMP	0.0	0.0	0.0	0.0	0.0	2.8	232.8	0.0	0.0	0.0	0.0
Corynoneura	CORYNON	0.0	0.0	0.0	2.6	0.1	33.6	0.8	0.0	0.0	0.0	0.0
Cricotopus	CRICOTP	0.0	68.0	6.6	0.0	0.1	0.0	3.2	0.0	3.0	18.4	1.0
Cricotopus (Nostococladius)	CRICNOS	0.0	0.0	0.0	0.0	5.5	321.0	0.0	96.0	6.0	0.8	0.0
Cryptochironomus	CRYPCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	12.0	0.0	0.0
Dicrotendipes	DICRTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Djalmabatista	DJALMAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	0.0	102.4	66.9	3.5	0.0	27.0	0.0	2.0	8.0	90.4	13.0
Eukiefferiella/Thienemanniella	EUKTHIE	0.0	13.6	2.4	0.0	0.0	2.8	0.0	1.0	0.0	0.0	0.0
Eukiefferiella	EUKIELL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	0.0	0.0	0.0	2.9	0.3	5.6	0.0	2.0	0.0	0.0	0.0
Heterotrissocladius	HETRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
Labrundinia	LABRUND	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0
Larsia	LARSIAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lauterborniella	LAUTERB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Lopescladius	LOPESCL	0.0	0.0	0.0	0.0	0.0	0.0	30.4	0.0	0.0	0.0	0.0
nr. Lopescladius	NRLOPES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Mesocricotopus	MESCRIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micropsectra	MICROPS	0.0	0.0	1.2	0.0	0.1	18.0	3.2	22.0	0.0	0.0	0.0
Microtendipes	MICRTEN	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanocladius	NANCLDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Nilotanypus	NILOTAN	0.0	0.0	0.0	0.0	0.0	3.4	0.0	6.0	0.0	0.0	0.0
Nilothauma	NILOTHA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	0.0	0.0	4.5	0.0	0.0	0.0	0.0	9.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Little Colorado River Basin										
		LCR9	LCR3	LCR2	LIL1	MAM1	MIN1	PAD1	RUD1	SLC1	WLC1	WLC2
Orthocladiinae-unknown genus	ORTHCLU	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius complex	ORTHCL1	0.0	40.8	6.6	0.0	3.8	18.0	4.8	8.0	0.0	0.0	0.0
Orthocladius (Orthocladius)	ORTHCLO	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	0.0	0.0	10.8	0.0	0.1	2.8	1.6	0.0	0.0	0.8	0.0
Pagastia	PAGASTI	0.0	6.8	0.0	1.4	1.9	53.4	0.0	7.0	0.0	0.0	0.0
Parachaetocladius	PRCHAET	0.0	0.0	0.0	0.3	3.8	0.0	0.0	0.0	0.0	0.0	0.0
nr. Parachaetocladius	NRPRCHT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	0.0	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0
Parakiefferiella	PRKIEFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parametriocnemus	PRMETRI	0.0	20.4	0.0	1.4	0.1	5.6	0.0	6.0	0.0	0.0	0.0
Paraphaenocladius	PRPHAEN	0.0	0.0	0.0	1.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0
Paratanytarsus	PRTANYT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	0.0	0.4	0.3	1.2	0.0	1.8	0.0	11.0	1.0	0.0	0.0
Parochlus kiefferi	PARKIEF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pentaneura cf. inconspicua	PENTINC	0.0	0.0	2.7	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Pentaneura n. sp.	PENTANN	0.0	7.2	0.0	0.0	0.0	0.6	0.0	18.0	0.0	0.0	0.0
Phaenopsectra	PHAENOP	0.0	4.4	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polypedilum	POLYPED	0.0	7.2	16.5	0.0	0.0	8.2	0.0	8.0	6.0	3.2	1.0
Potthastia	POTTHST	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.8	3.0
Procladius	PROCLAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prodiamesa	PRODIAM	0.0	0.0	0.3	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudochironomus	PSDCHIR	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosmittia	PSDSMIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psilometriocnemus	PSDMETR	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheocricotopus	RHEOCRC	0.0	6.8	0.3	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Rheopelopia	RHEOPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheotanytarsus	RHEOTAN	0.0	0.0	0.0	0.0	0.0	2.8	3.2	1.0	0.0	0.0	6.0
Robackia	ROBACKI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Robackia	NROBACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saetheria	SAETHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smittia	SMITTIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Stempellinella	STEMPEL	0.0	0.0	3.6	3.5	4.2	65.6	0.0	2.0	6.0	0.0	0.0
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	0.0	0.0	1.8	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
Stilocladius	STILOCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Synorthocladius	SYNORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tanytarsus	TANYTAR	0.0	0.0	0.3	2.1	0.0	10.8	1.6	2.0	0.0	0.0	0.0
Telopelopia okoboji	TELOPOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	THIENEL	0.0	0.0	0.9	0.0	0.0	4.2	0.8	0.0	0.0	0.0	0.0
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tvetenia	TVETENI	0.0	47.6	19.8	0.0	0.0	2.8	0.0	45.0	6.0	0.0	1.0
Xestochironomus	XESTCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	55.0	0.0	4.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle + Pool, untransformed data)

Taxonomic name	Species Code	Middle Gila River Basin							
		AGF1	ANT1	ASH1	HAS1	LAC1	LIO1	POL1	SYD1
Hydra	HYDRAAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Turbellaria	TURBELL	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Nematoda	NEMATOM	0.0	0.0	5.2	5.2	10.6	0.0	3.4	0.0
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	32.0	2.4	10.4	12.0	0.2	2.4	0.0	0.0
Erpobdella	ERPOBDL	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossiphonia complanata	GLOSCOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pisidium	PISIDUM	0.0	0.0	15.6	15.6	0.0	0.0	0.0	0.0
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Physella	PHYSELL	390.4	225.6	0.0	0.0	12.8	43.2	6.0	53.6
Gyraulus	GYRAULS	0.0	0.0	0.0	0.0	0.0	2.4	9.6	2.6
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	32.0	2.4	114.4	114.4	32.0	74.4	0.0	12.0
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orconectes causeyi	ORCONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acari	ACARIII	281.6	40.8	0.0	0.0	51.2	51.3	51.4	143.3
Order - Odonata									
Aeshnidae-early instar	AESHNID	0.0	0.0	5.2	5.2	0.0	0.0	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordulegaster	CORDULG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gomphidae	GOMPHID	44.8	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Libellulidae	LIBELLU	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calopterygidae	CALOPTR	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0
Coenagrionidae	COENAGR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Argia	ARGIAAA	99.2	12.0	0.0	0.0	38.4	2.4	0.0	0.0
Enallagma/Ischnura	ENALLAG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lestidae	LESTIDE	22.4	36.0	0.0	0.0	0.8	0.0	10.2	1.7
Order - Ephemeroptera									
Baetidae	BAETIDE	1296.0	621.6	0.0	1.6	300.8	1.2	96.2	1429.7
Baetodes	BAETODS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caenis	CAENISS	0.0	168.0	5.2	5.2	115.2	134.4	0.0	7.4
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ephemerella	EPHEMER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Serratella micheneri	SERRATL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epeorus	EPEORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heptagenia/Nixe	HEPTAGN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Middle Gila River Basin							
		AGF1	ANT1	ASH1	HAS1	LAC1	LIO1	POL1	SYD1
Rhithrogena	RHITHRG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.0	0.0	134.4	2.4	1.2	0.0
Choroterpes/Thraulodes	CHORTHR	28.8	0.0	0.0	0.0	0.0	0.0	0.0	228.0
Paraleptophlebia	PARALEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	ISONYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameletus	AMELETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siphlonurus	SIPHLON	0.0	0.0	254.8	254.8	0.0	0.0	0.0	0.0
Leptohyphes	LEPTHYP	0.0	0.0	0.0	0.0	0.0	2.4	0.0	4.9
Tricorythodes	TRICORY	11632.0	19.2	0.0	0.0	531.2	194.4	0.0	352.0
Order - Plecoptera									
Capniidae	CAPNIID	0.0	0.0	5.2	10.0	0.0	0.0	0.0	0.0
Chloroperlidae	CHLRPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amphinemura	AMPHINM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	PERLODN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isoperla	ISOPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taeniopterygidae	TAENIOP	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Hemiptera									
Belastomatidae	BELOSTM	0.0	0.0	0.0	0.0	0.0	0.2	3.4	4.0
Abedus	ABEDUSS	0.0	8.0	0.0	0.0	12.8	0.0	0.0	0.0
Corixidae	CORIXID	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Ambrysus	AMBRYSU	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0
Notonectidae	NOTONEC	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera									
Corydalus cornutus	CORYCOR	9.6	0.0	0.0	0.0	6.4	2.4	0.0	4.0
Neohermes filicornis	NEOHERM	0.0	5.6	0.0	0.0	0.0	0.0	5.8	0.0
Order - Trichoptera									
Brachycentrus	BRACHYC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micrasema	MICRASM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phylloicus	PHYLLOI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agapetus	AGAPETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culoptila	CULOPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossosoma	GLOSSOS	44.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	44.8	0.0	0.0	0.0	6.4	0.0	0.0	4.0
Atopsyche	ATPSYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheumatopsyche	CHEUMAT	524.8	38.4	0.0	0.0	345.6	0.0	0.0	1188.0
Hydropsyche	HYDROPS	118.4	121.6	0.0	0.0	588.8	0.0	1.2	28.0
Leptonema	LEPTONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptilidae-early instar	HYDTILD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptila	HYDTILA	134.4	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Ithytrichia	ITHYTRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leucotrichia	LEUCOTR	0.0	0.0	0.0	0.0	70.4	0.0	0.0	40.0
Mayatrichia	MAYATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neotrichia	NEOTRIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Ochrotrichia	OCHROTR	28.8	99.2	0.0	472.0	80.6	0.0	0.0	108.0

Invertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Middle Gila River Basin							
		AGF1	ANT1	ASH1	HAS1	LAC1	LIO1	POL1	SYD1
Oxyethira	OXYETHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-turret case	LEPTURR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	22.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oecetis	OECETIS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	HESPERO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilus	LIMPHIL	0.0	0.0	15.6	15.6	0.0	0.0	0.0	0.0
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marilia	MARILIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chimarra	CHIMARR	0.0	0.0	0.0	0.0	57.6	0.0	0.0	36.0
Wormaldia	WORMALD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	POLYCEN	9.6	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Polyplectropus	POLYPLE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	GUMAGAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera									
Petrophila	PETROPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Order - Coleoptera									
Dytiscidae	DYTISCD	134.4	168.8	130.0	134.8	23.0	9.6	243.0	31.2
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Postelichus	POSTELS	208.0	19.2	0.0	0.0	0.0	0.0	2.4	0.0
Cleptelmis	CLEPTEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterelmis	HETRLMN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	MACRELM	22.4	2.4	0.0	0.0	25.6	0.0	0.0	12.0
Microcylloepus	MICYLEP	128.0	0.0	0.0	0.0	6.4	2.4	0.0	48.0
Narpus	NARPUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neocylloepus	NEOCYLL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neoelmis	NEOELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Optioservus	OPTIOSR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Xenelmis	XENELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	ZAITZEV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Middle Gila River Basin							
		AGF1	ANT1	ASH1	HAS1	LAC1	LIO1	POL1	SYD1
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	GYRINUS	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	32.0	8.0	5.2	5.2	0.0	12.0	1.2	33.6
Hydrophilidae other	HYDPHIL	144.0	29.6	0.0	0.0	0.4	0.5	0.0	16.2
Berosus	BEROSUS	0.0	7.2	0.0	0.0	0.0	0.0	4.8	98.6
Tropisternus	TROPIST	0.0	0.0	0.0	0.0	0.0	1.4	6.8	0.0
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Diptera									
Atherix	ATHERIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopoginidae	CERTPGD	76.8	0.0	0.0	0.0	0.0	0.0	6.0	11.8
Ceratopogoninae	CERTPGN	1718.4	240.0	10.4	13.6	527.0	128.1	18.4	383.9
Forcipomyiinae	FORCIPO	0.0	7.2	0.0	0.0	0.0	0.3	10.2	6.0
Dixa	DIXAAAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dixella	DIXELLA	0.0	0.0	0.0	0.0	0.0	0.2	10.2	0.0
Meringodixa	MERINGO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chelifera	CHELIFR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clinocera	CLINOCR	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0
Hemerodromia	HEMEROD	9.6	0.0	0.0	0.0	6.4	2.4	1.2	20.0
Ephydridae	EPHYDRI	9.6	19.2	0.0	0.0	0.0	18.8	10.2	0.0
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	MARUINA	0.0	0.0	0.0	0.0	6.4	0.0	0.0	8.0
Pericoma	PERICOM	0.0	2.4	0.0	1.6	128.0	4.8	0.0	32.0
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	SIMULII	521.6	1682.4	0.0	67.2	52.0	5.7	280.6	17.6
Stratiomyiidae	STRATIO	41.6	94.4	15.6	15.6	6.4	0.0	0.0	380.0
Syrphidae	SYRPHID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	22.4	2.4	0.0	0.0	38.4	2.4	0.0	28.0
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antocha	ANTOCHA	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicranota	DICRANO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoconopa	HESPCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	9.6	0.0	0.0	0.0	6.4	0.0	0.0	16.0
Holorusia	HOLORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.0	0.0	0.3	0.0	8.0
Molophilus	MOLOPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	TIPULAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances Reference Sites in Arizona, 1992 (Combined Fall + Post, untransformed data)

Taxonomic name	Species Code	Middle Gila River Basin							
		AGF1	ANT1	ASH1	HAS1	LAC1	LIO1	POL1	SYD1
Family - Chironomidae									
Ablabesmyia	ABLABES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	ALOTANY	0.0	0.0	98.8	98.8	0.0	0.0	0.0	0.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	APEDILU	9.6	69.6	0.0	0.0	0.2	62.9	96.6	17.9
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0
Brundiniella	BRUNDIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryophaenocladius	BRYOPHN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	9.6	3.2	0.0	0.0	0.0	0.0	2.4	11.8
Chaetocladius	CHAETOC	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia	CONCHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	54.4	0.0	52.0	52.0	153.8	5.7	23.8	18.6
Constempellina	CONSTMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corynoneura	CORYNON	0.0	5.6	5.2	5.2	12.8	4.2	20.6	6.0
Cricotopus	CRICOTP	1465.6	175.2	0.0	1.6	11.8	69.6	109.2	240.6
Cricotopus (Nostococladius)	CRICNOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptochironomus	CRYPCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicrotendipes	DICRTND	9.6	2.4	62.4	62.4	0.0	7.2	14.0	17.9
Djalmabatista	DJALMAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	387.2	44.0	0.0	0.0	38.4	4.4	16.4	314.9
Eukiefferiella/Thienemanniella	EUKTHIE	0.0	6.4	0.0	0.0	0.0	0.0	0.0	11.8
Eukiefferiella	EUKIELL	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
Heterotrissocladius	HETRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labrundinia	LABRUND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Larsia	LARSIAA	0.0	74.4	0.0	0.0	0.0	0.0	0.0	0.0
Lauterborniella	LAUTERB	0.0	0.0	119.6	119.6	12.8	0.0	0.0	0.0
Lopescladius	LOPESCL	67.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Lopescladius	NRLOPES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Mesocricotopus	MESCRIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micropsectra	MICROPS	0.0	0.0	0.0	0.0	0.0	0.9	31.8	1.7
Microtendipes	MICRTEN	0.0	0.0	5.2	5.2	25.6	14.4	0.0	6.0
Nanocladius	NANCLDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nilotanypus	NILOTAN	0.0	2.4	0.0	0.0	12.8	2.4	0.0	0.0
Nilothauma	NILOTHA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Middle Gila River Basin							
		AGF1	ANT1	ASH1	HAS1	LAC1	LIO1	POL1	SYD1
Orthocladiinae-unknown genus	ORTHCLU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
Orthocladius complex	ORTHCL1	96.0	32.8	5.2	6.8	20.8	29.4	152.2	94.0
Orthocladius (Orthocladius)	ORTHCLO	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	54.4	0.0	0.0	91.2	12.8	0.0	3.6	0.0
Pagastia	PAGASTI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachaetocladius	PRCHAET	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
nr. Parachaetocladius	NRPRCHT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parakiefferiella	PRKIEFF	9.6	2.4	0.0	0.0	0.0	0.0	3.4	11.8
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	0.0	0.0	0.0	0.0	0.0	0.0	37.4	0.0
Parametriocnemus	PRMETRI	0.0	3.2	0.0	1.6	13.4	0.9	6.8	11.8
Paraphaenocladius	PRPHAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratanytarsus	PRTANYT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	201.6	3.2	26.0	26.0	12.8	0.0	0.0	0.0
Parochlus kiefferi	PARKIEF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pentaneura cf. inconspicua	PENTINC	0.0	0.0	0.0	0.0	0.0	0.0	9.2	0.0
Pentaneura n. sp.	PENTANN	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Phaenopsectra	PHAENOP	0.0	0.0	0.0	0.0	12.8	2.4	27.2	0.0
Polypedilum	POLYPED	51.2	5.6	5.2	5.2	250.0	108.3	37.4	114.2
Potthastia	POTTHST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Procladius	PROCLAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Prodiamesa	PRODIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	19.2	0.0	0.0	0.0	0.0	3.5	0.0	0.0
Pseudochironomus	PSDCHIR	198.4	31.2	0.0	0.0	0.0	1.8	21.6	71.0
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosmittia	PSDSMIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psilometriocnemus	PSDMETR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheocricotopus	RHEOCRC	0.0	0.0	0.0	0.0	12.8	0.0	2.4	23.8
Rheopelopia	RHEOPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheotanytarsus	RHEOTAN	38.4	2.4	0.0	0.0	25.6	0.9	22.8	20.3
Robackia	ROBACKI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Robackia	NROBACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saetheria	SAETHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smittia	SMITTIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	STEMPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	22.4	0.0	31.2	31.2	0.0	4.8	0.0	6.0
Stilocladius	STILOCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Synorthocladius	SYNORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
Tanytarsus	TANYTAR	22.4	2.4	0.0	0.0	0.0	3.5	79.6	10.3
Telopelopia okoboji	TELOPOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	THIENEL	0.0	2.4	0.0	0.0	12.8	0.0	1.2	0.0
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	22.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tvetenia	TVETENI	0.0	0.0	0.0	0.0	6.4	6.0	5.8	0.0
Xestochironomus	XESTCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	22.4	9.6	119.6	119.6	0.0	0.0	28.4	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle + Pool Kick Form Data)

Taxonomic name	Species Code	Middle Salt River Basin											
		CGN1	CHE1	CHE2	CYN1	DEE1	GRE1	HAI1	REY1	SAL1	SPG1	TON1	WOR1
Hydra	HYDRAAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria	TURBELL	0.0	0.0	0.0	0.0	2.0	0.0	5.2	0.0	1.2	0.0	0.0	1.4
Nematoda	NEMATOM	0.0	7.2	0.0	1.4	1.3	0.0	5.2	0.0	0.0	3.4	0.0	0.0
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	0.0	2.4	32.4	31.6	48.6	34.0	11.0	34.0	7.2	19.6	1.6	4.9
Erpobdella	ERPOBDL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossiphonia complanata	GLOSCOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pisidium	PISIDUM	0.0	0.0	0.0	4.2	24.7	0.0	0.0	72.2	0.0	0.0	0.0	60.9
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Physella	PHYSELL	157.0	0.0	0.0	4.2	35.1	9.0	0.0	3.4	6.4	349.2	64.0	0.0
Gyraulus	GYRAULS	0.0	0.0	0.0	0.0	0.7	1.0	0.0	0.0	0.0	0.0	1.6	0.6
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	76.0	42.0	0.0	1.4	2.0	0.0	32.4	27.2	0.0	3.6	0.0	0.0
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Orconectes causeyi	ORCONEC	2.0	54.0	19.2	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acari	ACARIII	553.0	21.6	75.6	68.4	192.8	25.8	44.6	233.2	13.6	49.0	390.4	48.1
Order - Odonata													
Aeshnidae-early instar	AESHNID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	3.6	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	5.6
Cordulegaster	CORDULG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
Gomphidae	GOMPHID	1.0	4.0	2.8	0.4	0.0	0.0	15.6	0.0	0.0	0.0	0.0	1.8
Libellulidae	LIBELLU	12.0	0.0	10.8	0.0	0.0	2.8	69.4	0.0	0.0	1.8	0.0	0.0
Calopterygidae	CALOPTR	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
Coenagrionidae	COENAGR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Argia	ARGIAAA	11.0	24.0	2.8	1.2	0.0	25.4	5.2	22.8	0.0	8.8	0.0	1.8
Enallagma/Ischnura	ENALLAG	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	1.6	0.0
Lestidae	LESTIDE	0.0	0.0	0.0	0.0	0.0	0.0	20.8	0.0	0.0	63.0	0.0	0.0
Order - Ephemeroptera													
Baetidae	BAETIDE	559.0	430.4	428.8	489.8	16.3	672.0	353.6	353.2	166.4	301.2	456.0	48.6
Baetodes	BAETODS	0.0	3.6	12.0	0.0	0.0	131.6	0.0	0.0	0.0	1.6	68.8	0.0
Caenis	CAENISS	284.0	718.0	0.0	9.8	115.7	5.0	72.8	2.4	245.6	293.2	4.8	18.6
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ephemerella	EPHEMER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	6.0
Serratella micheneri	SERRATL	0.0	0.0	67.2	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epeorus	EPEORUS	0.0	3.6	0.0	25.2	0.7	0.0	0.0	5.6	0.0	38.4	3.2	39.9
Heptagenia/Nixe	HEPTAGN	0.0	0.0	8.4	243.6	79.3	0.0	1.2	5.6	0.0	0.0	0.0	44.1

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Middle Salt River Basin											
		CGN1	CHE1	CHE2	CYN1	DEE1	GRE1	HAI1	REY1	SAL1	SPG1	TON1	WOR1
Rhithrogena	RHITHRG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	227.8	0.0	0.0	0.0	0.0
Choroterpes/Thraulodes	CHORTHR	176.0	87.2	336.4	12.2	2.6	20.0	10.2	20.0	8.4	216.0	27.2	0.0
Paraleptophlebia	PARALEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.2
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	ISONYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameletus	AMELETS	0.0	0.0	0.0	0.0	20.0	15.0	0.0	0.0	1.2	0.0	0.0	0.0
Siphlonurus	SIPHLON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptohyphes	LEPTHYP	2.0	6.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	84.8	140.8	0.0
Tricorythodes	TRICORY	770.0	16.4	29.6	4.0	4.6	108.4	993.8	32.2	16.8	667.2	16032.0	33.6
Order - Plecoptera													
Capniidae	CAPNIID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0
Chloroperlidae	CHLRPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.2
Amphinemura	AMPHINM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	412.3
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	PERLODN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isoperla	ISOPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.4	0.0	0.0	0.0	0.7
Taeniopterygidae	TAENIOP	0.0	0.0	0.0	0.0	140.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Hemiptera													
Belastomatidae	BELOSTM	12.0	2.0	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0
Abedus	ABEDUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
Corixidae	CORIXID	0.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambrysus	AMBRYSU	0.0	0.0	0.0	15.4	6.5	0.0	0.0	15.2	9.2	20.0	89.6	0.6
Notonectidae	NOTONEC	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera													
Corydalus cornutus	CORYCOR	6.0	1.2	7.2	0.0	0.0	19.6	6.4	3.4	0.0	12.8	6.4	0.0
Neohermes filicornis	NEOHERM	0.0	0.0	0.0	0.0	16.0	8.0	0.0	1.6	0.0	6.6	0.0	0.0
Order - Trichoptera													
Brachycentrus	BRACHYC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micrasema	MICRASM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
Phylloicus	PHYLLOI	0.0	0.0	0.0	0.0	3.3	1.0	0.6	44.2	10.8	30.6	25.6	0.0
Agapetus	AGAPETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culoptila	CULOPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0
Glossosoma	GLOSSOS	0.0	0.0	0.0	2.8	12.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	4.0	0.0	2.8	4.2	9.1	0.0	0.0	0.0	1.2	9.0	0.0	13.3
Atopsyche	ATPSYCH	0.0	0.0	0.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9
Cheumatopsyche	CHEUMAT	40.0	82.8	127.2	4.2	2.6	22.4	5.2	4.0	0.8	76.8	89.6	3.0
Hydropsyche	HYDROPS	12.0	46.8	120.8	11.2	0.0	336.0	64.2	35.2	4.0	11.2	8.0	14.7
Leptonema	LEPTONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptilidae-early instar	HYDTILD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptila	HYDTILA	4.0	10.0	2.4	0.0	0.0	0.0	3.0	0.0	6.8	3.2	0.0	0.0
Ithytrichia	ITHYTRI	0.0	0.0	0.0	4.2	2.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
Leucotrichia	LEUCOTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mayatrichia	MAYATRI	0.0	0.0	0.0	0.0	0.0	0.0	5.4	27.2	0.0	8.0	0.0	0.0
Neotrichia	NEOTRIC	3.0	0.0	0.0	0.0	0.7	0.0	0.6	47.6	0.0	1.6	0.0	0.0
Ochrotrichia	OCHROTR	18.0	4.8	0.0	0.0	0.0	211.2	57.2	41.6	0.0	0.0	8.0	0.6

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Middle Salt River Basin											
		CGN1	CHE1	CHE2	CYN1	DEE1	GRE1	HAI1	REY1	SAL1	SPG1	TON1	WOR1
Oxyethira	OXYETHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	0.0	0.0	0.0	2.4	122.4	0.0	0.0	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
Lepidostoma-turret case	LEPTURR	0.0	0.0	0.0	0.0	0.0	1.0	0.0	20.4	19.2	7.2	0.0	4.9
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	24.0	0.0	0.0	0.0	0.0	0.0	6.4	3.4	0.0	0.0	0.0	0.0
Oecetis	OECETIS	1.0	0.0	0.0	0.0	0.0	0.0	0.0	360.4	2.4	1.8	0.0	0.0
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	HESPERO	0.0	0.0	0.0	1.4	5.2	0.0	0.0	5.6	3.6	0.0	0.0	15.4
Limnephilus	LIMPHIL	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marilia	MARILIA	3.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.4	1.8	0.0	0.0
Chimarra	CHIMARR	49.0	0.0	0.0	0.0	0.0	2.8	0.0	0.8	0.0	19.2	1.6	0.0
Wormaldia	WORMALD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	POLYCEN	0.0	6.0	8.4	0.0	2.0	2.8	15.6	9.2	3.6	4.8	38.4	3.5
Polyplectropus	POLYPLE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.4	2.0	5.4	0.0	0.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	GUMAGAA	0.0	0.0	0.0	4.2	16.3	0.0	2.4	40.6	78.4	9.0	0.0	0.7
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera													
Petrophila	PETROPH	0.0	0.0	4.8	4.6	0.0	0.0	1.2	0.0	0.0	1.6	1.6	1.8
Order - Coleoptera													
Dytiscidae	DYTISCD	96.0	2.0	2.8	0.0	0.0	30.0	31.8	3.4	0.4	1.8	16.0	2.4
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	1.0	0.0	0.0	2.8	2.6	0.0	0.6	3.4	0.0	5.4	1.6	0.0
Postelichus	POSTELS	2.0	0.0	0.0	0.0	0.0	0.0	16.2	2.4	1.6	40.2	1.6	0.0
Cleptelmis	CLEPTEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	0.0	0.0	0.4	0.0	0.0	0.0	17.0	0.0	1.6	0.0	0.0
Heterelmis	HETRLMN	0.0	0.0	0.0	4.2	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	MACRELM	3.0	0.0	0.0	30.8	0.7	0.0	1.8	5.0	0.0	17.8	14.4	0.6
Microcylloepus	MICYLEP	66.0	0.0	12.4	8.4	2.6	44.8	67.8	247.2	18.8	29.0	57.6	4.2
Narpus	NARPUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Neocylloepus	NEOCYLL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0
Neoelmis	NEOELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
Optioservus	OPTIOSR	0.0	0.0	0.0	100.8	9.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Xenelmis	XENELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	ZAITZEV	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	149.1
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Middle Salt River Basin											
		CGN1	CHE1	CHE2	CYN1	DEE1	GRE1	HAI1	REY1	SAL1	SPG1	TON1	WOR1
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	0.0
Gyrinus	GYRINUS	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	3.6	0.0	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	180.0	2.0	0.0	0.0	0.0	5.6	78.0	0.0	0.4	0.0	0.0	0.0
Hydrophilidae other	HYDPHIL	12.0	0.0	2.8	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0
Berosus	BEROSUS	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tropisternus	TROPIST	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	13.0	1.2	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
Order - Diptera													
Atherix	ATHERIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	0.0	2.0	0.0	0.0	6.4	0.0	0.0	0.0	0.7
Ceratopoginidae	CERTPGD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	CERTPGN	738.0	65.2	67.2	16.6	27.5	32.8	312.2	165.2	9.6	161.4	1694.4	129.6
Forcipomyiinae	FORCIPO	0.0	0.0	0.0	0.4	0.0	2.8	0.6	0.0	0.0	0.0	0.0	0.0
Dixa	DIXAAAA	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
Dixella	DIXELLA	24.0	2.4	0.0	0.0	0.0	0.0	15.6	13.6	0.0	0.0	0.0	0.0
Meringodixa	MERINGO	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Chelifera	CHELIFR	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.8	0.0	0.0	0.0	9.8
Clinocera	CLINOCR	0.0	0.0	4.8	0.0	4.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
Hemerodromia	HEMEROD	5.0	1.2	7.2	0.0	0.0	8.4	2.4	0.8	0.0	1.6	0.0	0.0
Ephydridae	EPHYDRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	MARUINA	0.0	0.0	12.0	0.0	0.7	2.8	0.0	0.0	0.4	6.4	0.0	0.6
Pericoma	PERICOM	1.0	2.0	2.8	0.0	0.0	2.8	6.4	0.0	0.0	0.0	0.0	0.0
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	SIMULII	142.0	1.2	190.0	7.0	456.0	690.0	25.6	315.2	179.2	13.2	830.4	7.6
Stratiomyiidae	STRATIO	69.0	6.4	0.0	0.0	0.0	30.8	36.4	5.8	1.6	11.2	0.0	1.4
Syrphidae	SYRPHID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	16.0	0.0	2.4	5.6	0.0	11.2	0.0	2.4	0.0	4.8	1.6	0.0
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0
Antocha	ANTOCHA	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicranota	DICRANO	0.0	0.0	0.0	2.8	0.0	0.0	1.2	0.0	0.0	1.6	0.0	9.8
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoconopa	HESPCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	30.0	17.6	22.4	0.0	0.0	0.0	0.0	63.4	28.8	3.2	0.0	7.3
Holorusia	HOLORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Molophilus	MOLOPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	TIPULAA	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.4

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle + Pool Quantitative Data)

Taxonomic name	Species Code	Middle Salt River Basin											
		CGN1	CHE1	CHE2	CYN1	DEE1	GRE1	HAI1	REY1	SAL1	SPG1	TON1	WOR1
Family - Chironomidae													
Ablabesmyia	ABLABES	0.0	0.0	2.8	1.6	0.0	0.0	15.6	0.0	0.0	0.0	0.0	1.2
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	ALOTANY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	APEDILU	60.0	0.0	4.8	15.6	0.0	4.9	67.6	0.0	2.3	187.2	0.0	0.0
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.0	0.0	0.0	0.0	10.7	10.0	0.0	0.0	0.0	1.8	1.6	2.0
Brundiniella	BRUNDIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Bryophaenocladius	BRYOPHN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	7.0	2.0	19.2	0.0	0.0	1.0	5.2	0.0	2.3	0.0	0.0	0.0
Chaetocladius	CHAETOC	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	0.0	16.0	4.8	0.0	0.0	0.0	1.2	0.0	0.0	0.0	1.2
Conchapelopia	CONCHAP	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	66.0	17.2	2.8	8.2	22.9	11.0	12.2	42.4	0.0	30.0	52.8	1.9
Constempellina	CONSTMP	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Corynoneura	CORYNON	1.0	3.2	0.0	1.4	1.3	10.8	15.6	6.4	54.1	3.6	0.0	0.6
Cricotopus	CRICOTP	31.0	32.8	36.0	19.8	0.7	137.2	182.0	3.4	29.6	31.4	1.6	0.0
Cricotopus (Nostococladius)	CRICNOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptochironomus	CRYPCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	1.0	0.0	0.0	18.2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicrotendipes	DICRTND	0.0	0.0	0.0	0.4	0.0	0.0	41.6	0.0	0.0	0.0	0.0	0.0
Djalmabatista	DJALMAB	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	139.0	24.0	69.6	26.8	9.3	63.7	9.0	81.2	302.8	11.6	52.8	4.6
Eukiefferiella/Thienemanniella	EUKTHIE	14.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	0.0	1.6	13.3
Eukiefferiella	EUKIELL	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.6	1.8
Heterotrissocladius	HETRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Labrundinia	LABRUND	12.0	0.0	0.0	0.0	0.0	0.0	15.6	3.4	0.0	0.0	0.0	0.0
Larsia	LARSIAA	0.0	0.0	2.8	0.0	0.0	0.0	0.0	6.8	9.6	9.0	51.2	0.0
Lauterborniella	LAUTERB	60.0	2.0	0.0	0.0	0.0	0.0	15.6	0.0	0.0	1.8	12.8	0.0
Lopescladius	LOPESCL	0.0	1.2	2.8	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.0	0.6
nr. Lopescladius	NRLOPES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Mesocricotopus	MESCRIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Micropsectra	MICROPS	0.0	0.0	28.8	2.8	2.0	4.9	0.0	0.0	4.6	0.0	0.0	2.4
Microtendipes	MICRTEN	0.0	0.0	0.0	0.4	0.7	0.0	1.8	6.8	0.0	0.0	12.8	0.0
Nanocladius	NANCLDS	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	1.8	0.0	0.0
Nilotanypus	NILOTAN	0.0	2.0	0.0	0.0	4.0	6.0	0.0	5.6	7.1	4.8	0.0	0.0
Nilothauma	NILOTHA	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Middle Salt River Basin											
		CGN1	CHE1	CHE2	CYN1	DEE1	GRE1	HAI1	REY1	SAL1	SPG1	TON1	WOR1
Orthocladiinae-unknown genus	ORTHCLU	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
Orthocladius complex	ORTHCL1	316.0	13.2	10.4	54.0	6.0	21.6	105.2	39.6	17.2	29.4	6.4	2.8
Orthocladius (Orthocladius)	ORTHCLO	0.0	4.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.6
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	9.0	12.0	9.6	4.2	5.9	191.1	0.0	1.2	2.3	1.8	113.6	9.0
Pagastia	PAGASTI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2
Parachaetocladius	PRCHAET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Parachaetocladius	NRPRCHT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.0
Parakiefferiella	PRKIEFF	1.0	0.0	7.2	0.8	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	0.0	0.0	0.0	0.0	0.0	0.0	20.8	0.0	0.0	0.0	0.0	0.0
Parametriocnemus	PRMETRI	0.0	0.0	19.2	1.4	0.0	0.0	0.0	0.0	0.0	1.8	0.0	2.7
Paraphaenocladius	PRPHAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Paratanytarsus	PRTANYT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	2.0	4.0	2.4	2.8	0.0	0.0	0.6	10.2	1.2	1.6	0.0	0.0
Parochlus kiefferi	PARKIEF	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Pentaneura cf. inconspicua	PENTINC	0.0	4.8	31.2	0.4	6.0	7.9	0.0	3.4	0.0	0.0	0.0	0.0
Pentaneura n. sp.	PENTANN	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Phaenopsectra	PHAENOP	216.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
Polypedilum	POLYPED	421.0	54.8	67.2	34.6	22.6	35.5	42.8	29.6	2.3	46.6	0.0	3.8
Potthastia	POTTHST	0.0	0.0	10.0	20.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Procladius	PROCLAD	36.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prodiamesa	PRODIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudochironomus	PSDCHIR	264.0	0.0	0.0	0.0	0.0	4.9	36.4	0.0	0.0	5.4	25.6	1.2
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosmittia	PSDSMIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psilometriocnemus	PSDMETR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheocricotopus	RHEOCRC	0.0	15.6	33.6	0.0	0.0	83.3	5.2	3.4	2.3	16.0	0.0	0.0
Rheopelopia	RHEOPEL	2.0	0.0	0.0	0.0	0.0	3.0	0.0	1.2	16.8	0.0	0.0	0.0
Rheotanytarsus	RHEOTAN	0.0	8.4	33.6	0.8	0.7	24.5	0.0	0.0	0.0	17.8	1.6	29.4
Robackia	ROBACKI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Robackia	NROBACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Saetheria	SAETHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smittia	SMITTIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	STEMPEL	12.0	0.0	14.4	0.0	0.7	0.0	5.8	0.0	1.2	0.0	1.6	19.5
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	660.0	2.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	10.6	12.8	0.6
Stilocladius	STILOCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Synorthocladius	SYNORTH	2.0	0.0	2.4	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Tanytarsus	TANYTAR	48.0	0.0	4.8	24.0	0.0	1.0	5.2	0.0	6.8	5.4	3.2	4.2
Telopelopia okoboji	TELOPOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	THIENEL	0.0	2.0	2.8	4.2	0.0	0.0	5.2	8.8	38.8	1.6	0.0	0.0
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	0.0	4.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.8	0.0	0.0
Tvetenia	TVETENI	1.0	0.0	7.6	8.8	0.0	0.0	0.0	44.8	0.0	3.2	1.6	27.3
Xestochironomus	XESTCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	48.0	4.0	8.4	0.0	2.7	9.0	0.0	3.4	0.0	25.2	0.0	1.3

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Colorado River Mainstem/Grand Canyon									
		BRA1	HAV1	HER1	KAN1	MAT1	NAN1	PAR1	ROY1	SPC1	TAP1
Hydra	HYDRAAA	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0
Turbellaria	TURBELL	0.0	0.7	15.2	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Nematoda	NEMATOM	2.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	7.6	0.2	14.8	1.0	4.5	0.2	0.0	21.0	11.6	4.8
Erpobdella	ERPOBDL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossiphonia complanata	GLOSCOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pisidium	PISIDUM	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Physella	PHYSELL	0.0	0.3	0.0	0.0	0.0	0.0	0.0	63.0	9.0	0.0
Gyraulus	GYRAULS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	3.8	7.3	912.8	314.9	2.5	0.2	0.0	12.0	2409.6	228.4
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orconectes causeyi	ORCONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acari	ACARIII	41.9	0.4	7.2	10.5	14.2	24.4	0.0	10.0	17.2	4.0
Order - Odonata											
Aeshnidae-early instar	AESHNID	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordulegaster	CORDULG	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gomphidae	GOMPHID	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Libellulidae	LIBELLU	0.0	0.0	144.0	10.4	8.3	6.2	0.0	0.0	22.8	4.4
Calopterygidae	CALOPTR	0.0	0.1	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coenagrionidae	COENAGR	0.0	0.2	0.0	0.0	0.0	17.0	0.0	0.0	7.0	0.0
Argia	ARGIAAA	3.8	0.1	399.6	25.2	8.8	6.2	0.0	5.0	395.2	8.0
Enallagma/Ischnura	ENALLAG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lestidae	LESTIDE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Ephemeroptera											
Baetidae	BAETIDE	735.7	83.4	675.6	190.6	219.8	104.8	4.8	58.2	764.2	372.4
Baetodes	BAETODS	68.4	0.1	7.2	2.2	0.0	17.0	0.0	0.0	0.0	0.0
Caenis	CAENISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ephemerella	EPHEMER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Serratella micheneri	SERRATL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epeorus	EPEORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.0
Heptagenia/Nixe	HEPTAGN	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Colorado River Mainstem/Grand Canyon									
		BRA1	HAV1	HER1	KAN1	MAT1	NAN1	PAR1	ROY1	SPC1	TAP1
Rhithrogena	RHITHRG	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Choroterpes/Thraulodes	CHORTHR	0.0	0.0	0.8	0.0	6.1	0.2	0.0	0.0	0.0	0.0
Paraleptophlebia	PARALEP	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	ISONYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameletus	AMELETS	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siphlonurus	SIPHLON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptohyphes	LEPTHYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tricorythodes	TRICORY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Plecoptera											
Capniidae	CAPNIID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chloroperlidae	CHLRPER	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amphinemura	AMPHINM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	PERLODN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0
Isoperla	ISOPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taeniopterygidae	TAENIOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Hemiptera											
Belastomatidae	BELOSTM	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0
Abedus	ABEDUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corixidae	CORIXID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambrysus	AMBRYSU	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	22.8	0.4
Notonectidae	NOTONEC	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.4
Order - Megaloptera											
Corydalus cornutus	CORYCOR	3.8	0.0	36.0	1.9	9.6	1.0	0.0	2.0	107.4	0.0
Neohermes filicornis	NEOHERM	0.0	0.0	0.0	1.5	0.0	0.0	0.0	1.0	0.0	0.0
Order - Trichoptera											
Brachycentrus	BRACHYC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micrasema	MICRASM	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
Phylloicus	PHYLLOI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agapetus	AGAPETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culoptila	CULOPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossosoma	GLOSSOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	136.8	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Atopsyche	ATPSYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheumatopsyche	CHEUMAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	585.2	1.2
Hydropsyche	HYDROPS	53.2	9.5	92.4	2.5	0.0	0.0	28.0	0.0	0.0	14.0
Leptonema	LEPTONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptilidae-early instar	HYDTILD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
Hydroptila	HYDTILA	0.0	0.0	10.8	0.7	15.2	11.6	0.0	0.0	334.4	11.2
Ithytrichia	ITHYTRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leucotrichia	LEUCOTR	0.0	0.1	0.0	0.0	0.5	0.0	0.0	0.0	76.0	0.4
Mayatrichia	MAYATRI	0.0	0.2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neotrichia	NEOTRIC	3.8	0.1	0.0	42.2	27.5	0.0	0.0	0.0	0.0	0.0
Ochrotrichia	OCHROTR	26.6	0.4	11.6	0.0	0.0	3.0	0.0	132.0	10.6	0.0

[redacted]oin[redacted]bra[redacted]bun[redacted]ces [redacted]fer[redacted] Sit[redacted] Ari[redacted], 19[redacted] (Cor[redacted]ed [redacted] + P[redacted], untr[redacted]orm[redacted] data) [redacted]

Taxonomic name	Species Code	Colorado River Mainstem/Grand Canyon									
		BRA1	HAV1	HER1	KAN1	MAT1	NAN1	PAR1	ROY1	SPC1	TAP1
Oxyethira	OXYETHR	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0
Lepidostoma-turret case	LEPTURR	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oecetis	OECETIS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	HESPERO	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilus	LIMPHIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marilia	MARILIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chimarra	CHIMARR	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wormaldia	WORMALD	0.0	0.0	68.4	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Polycentropus	POLYCEN	3.9	0.0	7.2	2.5	29.3	3.8	0.0	0.0	1.0	0.0
Polyplectropus	POLYPLE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Gumaga	GUMAGAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera											
Petrophila	PETROPH	7.6	0.0	0.0	0.5	0.0	0.0	0.0	0.0	15.2	0.0
Order - Coleoptera											
Dytiscidae	DYTISCD	11.7	0.2	1.6	0.0	6.6	3.4	0.0	0.0	0.0	0.0
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Postelichus	POSTELS	0.0	0.0	3.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Cleptelmis	CLEPTEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterelmis	HETRLMN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.2	0.0
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	MACRELM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microcylloepus	MICYLEP	539.6	6.2	219.6	0.6	0.0	12.0	0.0	8.0	1.0	0.0
Narpus	NARPUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neocylloepus	NEOCYLL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neoelmis	NEOELMS	0.0	0.0	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0
Optioservus	OPTIOSR	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	6.0
Xenelmis	XENELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	ZAITZEV	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Colorado River Mainstem/Grand Canyon									
		BRA1	HAV1	HER1	KAN1	MAT1	NAN1	PAR1	ROY1	SPC1	TAP1
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	GYRINUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	11.6	0.0
Hydrophilidae other	HYDPHIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berosus	BEROSUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tropisternus	TROPIST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Diptera											
Atherix	ATHERIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopoginidae	CERTPGD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	CERTPGN	36.4	1.0	93.6	8.2	19.8	25.6	0.0	13.2	225.4	8.0
Forcipomyiinae	FORCIPO	0.0	0.0	0.0	0.0	1.6	0.0	0.0	3.0	2.0	0.0
Dixa	DIXAAAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dixella	DIXELLA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Meringodixa	MERINGO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chelifera	CHELIFR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clinocera	CLINOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	6.0
Hemerodromia	HEMEROD	0.0	0.0	14.4	1.5	0.5	7.0	0.0	13.0	100.8	0.8
Ephydridae	EPHYDRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Maruina	MARUINA	0.0	0.0	0.0	0.0	28.8	2.8	0.0	1.0	0.0	0.0
Pericoma	PERICOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	SIMULII	672.6	2.0	104.4	29.7	27.7	40.6	0.0	16.4	39.0	218.8
Stratiomyiidae	STRATIO	0.0	0.0	141.2	0.6	8.0	7.4	0.0	45.0	62.8	10.8
Syrphidae	SYRPHID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	0.0	0.1	10.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antocha	ANTOCHA	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	32.0
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicranota	DICRANO	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoconopa	HESPCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	6.5	0.0	0.0	0.0	28.8	7.0	0.0	0.0	22.8	0.0
Holorusia	HOLORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Molophilus	MOLOPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	TIPULAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[redacted]oin[redacted]bra[redacted]bun[redacted]ies at [redacted]eference Sites in Arizona, 19[redacted] (Combined [redacted]+Pool, untransformed data)

Taxonomic name	Species Code	Colorado River Mainstem/Grand Canyon									
		BRA1	HAV1	HER1	KAN1	MAT1	NAN1	PAR1	ROY1	SPC1	TAP1
Family - Chironomidae											
Ablabesmyia	ABLABES	3.9	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	ALOTANY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	APEDILU	0.0	0.0	0.0	4.2	9.5	2.6	0.0	18.5	30.4	0.0
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brundiniella	BRUNDIN	70.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryophaenocladius	BRYOPHN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	41.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chaetocladius	CHAETOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	45.5	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia	CONCHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	41.0	0.1	21.6	0.6	4.2	3.2	0.0	0.0	145.4	6.0
Constempellina	CONSTMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corynoneura	CORYNON	0.0	0.1	3.6	0.0	11.2	1.0	0.0	2.0	0.0	2.4
Cricotopus	CRICOTP	26.6	3.7	14.4	0.5	5.6	27.0	0.0	88.0	236.6	74.4
Cricotopus (Nostococladius)	CRICNOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptochironomus	CRYPCHR	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicrotendipes	DICRTND	0.0	0.0	0.0	0.2	2.3	0.8	0.0	0.0	0.0	1.2
Djalmabatista	DJALMAB	0.0	0.0	3.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	140.7	0.3	39.6	4.0	0.5	16.0	0.8	56.0	0.0	36.0
Eukiefferiella/Thienemanniella	EUKTHIE	7.6	0.0	21.6	0.0	0.0	1.0	0.0	2.0	7.6	0.0
Eukiefferiella	EUKIELL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterotrissocladius	HETRISS	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labrundinia	LABRUND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Larsia	LARSIAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lauterborniella	LAUTERB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lopescladius	LOPESCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Lopescladius	NRLOPES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Mesocricotopus	MESCRIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micropsectra	MICROPS	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Microtendipes	MICRTEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanocladius	NANCLDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0
Nilotanypus	NILOTAN	0.0	0.2	0.0	0.0	21.6	6.2	0.0	0.0	0.0	0.0
Nilothauma	NILOTHA	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Colorado River Mainstem/Grand Canyon									
		BRA1	HAV1	HER1	KAN1	MAT1	NAN1	PAR1	ROY1	SPC1	TAP1
Orthocladiinae-unknown genus	ORTHCLU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius complex	ORTHCL1	41.8	0.4	0.0	3.0	0.0	1.0	0.0	11.0	10.6	104.4
Orthocladius (Orthocladius)	ORTHCLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	11.4	0.7	0.0	0.0	0.0	6.0	0.0	5.5	0.0	130.0
Pagastia	PAGASTI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachaetocladius	PRCHAET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Parachaetocladius	NRPRCHT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	0.0	0.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Parakiefferiella	PRKIEFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Parametriocnemus	PRMETRI	2.0	0.1	3.6	0.5	0.0	0.0	0.0	28.0	0.0	16.0
Paraphaenocladius	PRPHAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratanytarsus	PRTANYT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	103.4	0.2	0.8	0.0	1.5	0.0	0.0	0.0	15.2	0.0
Parochlus kiefferi	PARKIEF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pentaneura cf. inconspicua	PENTINC	0.0	0.4	0.0	1.0	11.2	0.6	0.0	0.0	2.0	0.0
Pentaneura n. sp.	PENTANN	0.0	0.0	0.0	0.0	2.1	1.6	0.0	5.5	1.0	0.0
Phaenopsectra	PHAENOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polypedilum	POLYPED	17.9	1.7	11.6	1.4	3.0	0.4	0.0	0.0	510.2	20.8
Potthastia	POTTHST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Procladius	PROCLAD	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Prodiamesa	PRODIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudochironomus	PSDCHIR	0.0	0.0	0.0	0.0	0.0	0.4	0.0	2.0	8.6	0.4
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosmittia	PSDSMIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psilometriocnemus	PSDMETR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheocricotopus	RHEOCRC	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheopelopia	RHEOPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rheotanytarsus	RHEOTAN	110.1	1.7	144.0	0.4	0.8	0.0	0.0	18.5	0.0	2.0
Robackia	ROBACKI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Robackia	NROBACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saetheria	SAETHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smittia	SMITTIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	STEMPEL	33.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	7.0	0.0
Stilocladius	STILOCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Synorthocladius	SYNORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Tanytarsus	TANYTAR	3.9	0.0	62.0	12.3	14.9	0.8	0.0	4.0	0.0	0.8
Telopelopia okoboji	TELOPOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	THIENEL	0.0	0.1	7.2	0.0	0.0	0.0	0.0	0.0	15.2	0.4
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Tvetenia	TVETENI	0.0	0.0	0.0	1.5	0.0	0.0	0.0	2.0	0.0	2.0
Xestochironomus	XESTCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	113.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Santa Cruz River Basin							
		CAV1	CDO1	CIE1	GAR1	MAD1	SAB1	SCR1	SYS1
Hydra	HYDRAAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria	TURBELL	0.0	0.0	0.0	0.0	0.0	0.0	6.8	54.6
Nematoda	NEMATOM	0.0	0.0	4.1	3.2	0.0	0.0	23.2	15.9
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	2.4	8.0	8.4	58.5	7.6	26.4	37.4	50.1
Erpobdella	ERPOBDL	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.6
Glossiphonia complanata	GLOSCOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pisidium	PISIDUM	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0	2505.8	126.6
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Physella	PHYSELL	0.0	0.0	282.8	290.4	0.0	0.0	401.2	20.7
Gyraulus	GYRAULS	0.0	0.0	0.0	0.0	0.0	0.0	17.0	4.8
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	58.8	260.4	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	0.0	0.0	89.4	99.6	0.0	0.0	591.6	47.7
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orconectes causeyi	ORCONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acari	ACARIII	1.2	19.6	81.5	4.7	17.8	13.2	43.8	27.6
Order - Odonata									
Aeshnidae-early instar	AESHNID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordulegaster	CORDULG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gomphidae	GOMPHID	0.0	0.0	16.8	4.8	0.0	0.0	10.2	3.0
Libellulidae	LIBELLU	0.0	0.0	2.6	0.0	0.0	0.0	17.0	0.0
Calopterygidae	CALOPTR	0.0	0.0	2.8	1.2	0.0	0.0	0.0	0.0
Coenagrionidae	COENAGR	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0
Argia	ARGIAAA	0.0	0.0	8.4	16.8	0.0	2.2	71.4	73.5
Enallagma/Ischnura	ENALLAG	0.0	0.0	0.0	42.0	0.0	0.0	40.8	31.8
Lestidae	LESTIDE	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0
Order - Ephemeroptera									
Baetidae	BAETIDE	0.0	1047.2	560.7	97.8	19.7	577.8	696.8	246.6
Baetodes	BAETODS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caenis	CAENISS	0.0	0.0	0.0	0.0	0.5	211.6	95.2	18.0
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ephemerella	EPHEMER	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0
Serratella micheneri	SERRATL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epeorus	EPEORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heptagenia/Nixe	HEPTAGN	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Santa Cruz River Basin							
		CAV1	CDO1	CIE1	GAR1	MAD1	SAB1	SCR1	SYS1
Rhithrogena	RHITHRG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0
Choroterpes/Thraulodes	CHORTHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paraleptophlebia	PARALEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	ISONYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameletus	AMELETS	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0
Siphlonurus	SIPHLON	0.0	0.0	13.0	0.0	0.0	0.0	14.0	0.0
Leptohyphes	LEPTHYP	0.0	0.0	75.6	1.2	0.0	0.0	34.0	1.8
Tricorythodes	TRICORY	0.0	0.0	0.0	7.2	0.0	2.4	2140.2	337.8
Order - Plecoptera									
Capniidae	CAPNIID	2.4	0.8	0.0	0.8	0.0	0.0	5.6	0.0
Chloroperlidae	CHLRPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amphinemura	AMPHINM	0.0	0.0	0.0	0.8	0.0	0.0	5.6	0.0
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	PERLODN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isoperla	ISOPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taeniopterygidae	TAENIOP	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Order - Hemiptera									
Belastomatidae	BELOSTM	0.0	0.0	2.8	3.6	0.0	0.0	3.4	3.3
Abedus	ABEDUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corixidae	CORIXID	0.0	0.0	0.0	0.0	0.0	0.0	1196.8	0.6
Ambrysus	AMBRYSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Notonectidae	NOTONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera									
Corydalus cornutus	CORYCOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Neohermes filicornis	NEOHERM	3.6	12.0	1.3	8.3	4.9	15.4	0.0	0.0
Order - Trichoptera									
Brachycentrus	BRACHYC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micrasema	MICRASM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phylloicus	PHYLLOI	0.0	0.0	0.0	0.0	1.4	156.2	0.0	0.0
Agapetus	AGAPETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culoptila	CULOPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossosoma	GLOSSOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	0.0	0.0	0.0	0.0	0.0	50.6	0.0	0.6
Atopsyche	ATPSYCH	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0
Cheumatopsyche	CHEUMAT	0.0	0.0	33.6	0.0	0.0	0.0	0.0	0.0
Hydropsyche	HYDROPS	0.0	16.8	8.4	0.0	1.4	0.0	47.6	1.5
Leptonema	LEPTONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Hydroptilidae-early instar	HYDTILD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptila	HYDTILA	0.0	0.0	10.4	0.0	0.0	0.0	0.0	12.3
Ithytrichia	ITHYTRI	0.0	0.0	0.0	0.0	0.0	0.0	54.4	0.0
Leucotrichia	LEUCOTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mayatrichia	MAYATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neotrichia	NEOTRIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ochrotrichia	OCHROTR	0.0	0.0	36.4	1.2	1.4	2.2	0.0	24.0

Macroinvertebrate Abundances Reference Site Area, 19[redacted] (Co[redacted]ed [redacted] + P[redacted], untransformed data)

Taxonomic name	Species Code	Santa Cruz River Basin							
		CAV1	CDO1	CIE1	GAR1	MAD1	SAB1	SCR1	SYS1
Oxyethira	OXYETHR	0.0	0.0	114.8	134.4	0.0	0.0	0.0	26.4
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-turret case	LEPTURR	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	0.0	0.0	2.8	1.2	0.0	0.0	0.0	3.3
Oecetis	OECETIS	0.0	0.0	0.0	0.0	0.5	4.4	0.0	0.0
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	HESPERO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilus	LIMPHIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marilia	MARILIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chimarra	CHIMARR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wormaldia	WORMALD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	POLYCEN	0.0	0.0	0.0	0.0	0.0	2.4	0.0	4.5
Polyplectropus	POLYPLE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	GUMAGAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera									
Petrophila	PETROPH	0.0	0.0	16.8	0.0	0.0	0.0	0.0	0.0
Order - Coleoptera									
Dytiscidae	DYTISCD	0.0	44.0	309.4	8.3	6.3	63.8	19.2	9.0
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	0.0	0.0	2.8	0.0	0.0	2.2	10.2	0.6
Postelichus	POSTELS	0.0	0.0	0.0	3.0	0.0	0.0	9.6	4.5
Cleptelmis	CLEPTEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterelmis	HETRLMN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	MACRELM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microcylloepus	MICYLEP	0.0	0.0	1013.6	9.6	0.0	0.0	91.2	28.8
Narpus	NARPUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neocylloepus	NEOCYLL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neoelmis	NEOELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Optioservus	OPTIOSR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Xenelmis	XENELMS	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0
Zaitzevia	ZAITZEV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Santa Cruz River Basin							
		CAV1	CDO1	CIE1	GAR1	MAD1	SAB1	SCR1	SYS1
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	GYRINUS	0.0	0.0	9.1	0.0	0.0	0.0	0.0	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	0.0	0.0	2.8	2.4	0.0	0.0	367.2	41.7
Hydrophilidae other	HYDPHIL	0.0	0.0	0.0	4.4	0.0	0.0	3.4	0.0
Berosus	BEROSUS	0.0	0.0	5.2	0.0	0.0	0.0	77.0	10.8
Tropisternus	TROPIST	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Diptera									
Atherix	ATHERIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
Ceratopoginidae	CERTPGD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	CERTPGN	1.2	11.2	157.3	3.6	2.3	9.4	375.0	122.4
Forcipomyiinae	FORCIPO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dixa	DIXAAAA	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
Dixella	DIXELLA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8
Meringodixa	MERINGO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Chelifera	CHELIFR	0.0	0.0	0.0	0.0	1.8	2.2	0.0	0.0
Clinocera	CLINOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hemerodromia	HEMEROD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ephydridae	EPHYDRI	0.0	0.0	0.0	0.0	0.0	0.0	3.4	1.2
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	MARUINA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pericoma	PERICOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	SIMULII	506.4	1089.2	72.4	503.7	114.0	568.0	288.0	276.3
Stratiomyiidae	STRATIO	0.0	0.0	0.0	0.0	0.5	4.4	0.0	2.4
Syrphidae	SYRPHID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	0.0	0.0	2.8	0.0	0.0	0.0	0.0	1.5
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antocha	ANTOCHA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicranota	DICRANO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoconopa	HESPCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holorusia	HOLORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Molophilus	MOLOPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.0	0.9	2.2	0.0	0.0
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	TIPULAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Santa Cruz River Basin							
		CAV1	CDO1	CIE1	GAR1	MAD1	SAB1	SCR1	SYS1
Family - Chironomidae									
Ablabesmyia	ABLABES	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
Alotanypus	ALOTANY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Apedilum	APEDILU	0.0	0.0	22.8	0.0	0.0	0.0	0.0	2.4
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
Brundiniella	BRUNDIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryophaenocladius	BRYOPHN	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chaetocladius	CHAETOC	0.0	0.0	0.0	6.0	0.0	0.0	3.5	0.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia	CONCHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	0.0	28.0	59.4	0.8	4.5	99.0	14.0	0.0
Constempellina	CONSTMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corynoneura	CORYNON	0.0	0.4	0.0	0.0	2.5	13.8	58.8	4.4
Cricotopus	CRICOTP	0.0	6.0	195.7	76.2	4.1	2.2	13.9	108.2
Cricotopus (Nostococladius)	CRICNOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptochironomus	CRYPCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	0.0	0.0	0.0	0.0	8.1	0.0	0.0	0.0
Dicrotendipes	DICRTND	0.0	0.0	0.0	0.0	0.0	13.2	3.4	7.2
Djalmabatista	DJALMAB	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	8.4	72.8	35.7	22.7	15.6	11.6	273.7	6.0
Eukiefferiella/Thienemanniella	EUKTHIE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
Eukiefferiella	EUKIELL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	0.0	0.0	0.0	12.8	0.5	0.0	0.0	0.0
Heterotrissocladius	HETRISS	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	3.6	0.0	0.0	0.8	0.0	0.0	3.5	0.0
Labrundinia	LABRUND	0.0	0.0	0.0	26.4	0.0	0.0	13.6	35.3
Larsia	LARSIAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lauterborniella	LAUTERB	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0
Lopescladius	LOPESCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Lopescladius	NRLOPES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	4.8	0.0	0.0	0.0	0.0	2.2	0.0	0.0
nr. Mesocricotopus	MESCRIC	3.6	0.0	0.0	3.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micropsectra	MICROPS	0.0	0.0	3.9	3.2	0.9	0.0	3.4	3.6
Microtendipes	MICRTEN	0.0	0.0	7.8	0.0	0.0	0.0	3.4	0.0
Nanocladius	NANCLDS	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0
Nilotanypus	NILOTAN	0.0	0.0	0.0	0.0	8.6	8.8	3.5	0.0
Nilothauma	NILOTHA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Santa Cruz River Basin							
		CAV1	CDO1	CIE1	GAR1	MAD1	SAB1	SCR1	SYS1
Orthocladiinae-unknown genus	ORTHCLU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius complex	ORTHCL1	0.0	5.6	169.7	2.0	3.7	7.0	13.7	41.6
Orthocladius (Orthocladius)	ORTHCLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	36.0	46.0	5.6	23.0	61.6	4.4	7.0	119.3
Pagastia	PAGASTI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachaetocladius	PRCHAET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Parachaetocladius	NRPRCHT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parakiefferiella	PRKIEFF	0.0	0.4	0.0	2.4	0.0	0.0	0.0	6.0
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	0.0	0.0	0.0	0.0	0.0	6.6	3.4	0.0
Parametriocnemus	PRMETRI	0.0	11.2	13.9	5.3	1.8	2.2	0.0	3.8
Paraphaenocladius	PRPHAEN	0.0	0.0	0.0	2.0	0.9	2.2	0.0	0.0
Paratanytarsus	PRTANYT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parochlus kiefferi	PARKIEF	1.2	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Pentaneura cf. inconspicua	PENTINC	0.0	11.2	8.4	0.0	0.0	0.0	0.0	0.6
Pentaneura n. sp.	PENTANN	0.0	0.0	0.0	2.3	6.8	11.0	0.0	0.0
Phaenopsectra	PHAENOP	0.0	5.6	128.1	0.0	0.0	0.0	0.0	0.0
Polypedilum	POLYPED	0.0	5.6	115.9	0.0	0.8	9.4	7.0	0.0
Potthastia	POTTHST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Procladius	PROCLAD	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0
Prodiamesa	PRODIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	0.0	0.0	7.8	0.0	0.0	0.0	3.4	2.4
Pseudochironomus	PSDCHIR	0.0	0.0	45.5	2.4	0.0	0.0	0.0	0.0
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.8	0.5	0.0	0.0	0.0
Pseudosmittia	PSDSMIT	2.4	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Psilometriocnemus	PSDMETR	0.0	5.6	0.0	0.0	0.8	4.4	3.5	0.0
Rheocricotopus	RHEOCRC	2.4	1.2	0.0	33.0	9.1	6.6	31.5	0.0
Rheopelopia	RHEOPEL	0.0	0.0	0.0	0.0	0.5	22.0	0.0	0.0
Rheotanytarsus	RHEOTAN	0.0	11.2	22.8	1.2	0.0	0.0	6.8	19.8
Robackia	ROBACKI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Robackia	NROBACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saetheria	SAETHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smittia	SMITTIA	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	STEMPEL	0.0	0.0	0.0	0.0	0.0	9.0	3.5	0.0
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	0.0	0.0	18.2	0.0	0.0	0.0	0.0	0.0
Stilocladius	STILOCL	0.0	0.4	0.0	3.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Synorthocladius	SYNORTH	0.0	11.2	18.9	0.0	0.0	0.0	0.0	0.0
Tanytarsus	TANYTAR	0.0	5.6	0.0	0.8	0.9	2.2	0.0	4.2
Telopelopia okoboji	TELOPOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	THIENEL	0.0	0.0	3.9	3.6	0.9	0.0	0.0	8.3
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	0.0	0.0	7.8	0.0	0.0	0.0	0.0	0.0
Tvetenia	TVETENI	1.2	0.0	0.0	2.3	26.6	6.6	0.0	0.0
Xestochironomus	XESTCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	0.0	0.4	0.0	4.8	4.0	0.0	0.0	0.0

[redacted]oin[redacted]ebra[redacted]bun[redacted]ces [redacted]efer[redacted] Sit[redacted] Ari[redacted], 19[redacted] Cor[redacted]ed [redacted] + P[redacted], unt[redacted]orm[redacted] data) [redacted]

Taxonomic name	Species Code	San Pedro River Basin								
		ARA1	ARA2	BAS1	GOU1	HSC1	RAM1	RED1	SPR1	WAR1
Hydra	HYDRAAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria	TURBELL	0.0	0.0	0.0	2.0	0.0	8.6	1.2	10.8	0.0
Nematoda	NEMATOM	23.4	0.0	0.0	0.0	3.7	5.6	0.0	2.0	5.1
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	37.8	4.0	10.6	82.0	63.6	40.6	8.4	42.8	13.7
Erpobdella	ERPOBDL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossiphonia complanata	GLOSCOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pisidium	PISIDUM	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Physella	PHYSELL	1.0	0.0	0.0	0.0	0.0	0.0	0.0	18.4	25.0
Gyraulus	GYRAULS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	3.0	0.0	0.4	2.0	4.7	5.6	6.0	0.0	14.0
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Orconectes causeyi	ORCONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acari	ACARIII	421.8	21.2	92.4	152.0	29.8	18.2	3.6	25.2	17.0
Order - Odonata										
Aeshnidae-early instar	AESHNID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	0.0	0.0	14.0	6.0	0.0	15.3
Cordulegaster	CORDULG	0.0	0.0	0.0	0.0	0.0	25.2	10.8	0.0	1.7
Gomphidae	GOMPHID	7.2	2.4	3.4	0.0	3.2	3.2	0.0	4.0	9.0
Libellulidae	LIBELLU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Calopterygidae	CALOPTR	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	8.0
Coenagrionidae	COENAGR	0.0	0.0	0.0	0.0	0.0	2.8	3.6	0.4	2.0
Argia	ARGIAAA	7.0	1.6	6.2	3.0	16.0	17.8	9.6	4.0	3.4
Enallagma/Ischnura	ENALLAG	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lestidae	LESTIDE	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Ephemeroptera										
Baetidae	BAETIDE	1747.4	213.6	551.0	37.0	550.4	51.0	10.8	508.0	192.3
Baetodes	BAETODS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caenis	CAENISS	12.0	0.0	0.0	10.0	0.0	0.4	3.6	6.4	1.7
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ephemerella	EPHEMER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Serratella micheneri	SERRATL	759.0	106.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epeorus	EPEORUS	0.0	0.0	0.0	4.0	0.5	0.0	0.0	0.0	3.4
Heptagenia/Nixe	HEPTAGN	0.0	0.0	0.0	0.0	0.0	8.4	22.8	0.0	49.3

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	San Pedro River Basin								
		ARA1	ARA2	BAS1	GOU1	HSC1	RAM1	RED1	SPR1	WAR1
Rhithrogena	RHITHRG	0.0	78.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Choroterpes/Thraulodes	CHORTHR	51.4	44.4	233.8	67.0	876.8	25.4	175.2	70.8	5.0
Paraleptophlebia	PARALEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	ISONYCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameletus	AMELETS	0.0	0.0	0.0	2.0	1.0	0.0	4.8	0.0	0.0
Siphlonurus	SIPHLON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0
Leptohyphes	LEPTHYP	79.2	10.8	0.0	0.0	0.0	0.0	0.0	12.0	0.0
Tricorythodes	TRICORY	14.2	40.4	2169.8	331.0	268.8	40.6	13.2	18.8	130.7
Order - Plecoptera										
Capniidae	CAPNIID	0.0	0.0	0.0	0.0	0.5	0.0	1.2	0.0	0.0
Chloroperlidae	CHLRPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amphinemura	AMPHINM	0.0	0.0	0.0	0.0	0.5	333.2	6.0	0.0	61.2
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	PERLODN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isoperla	ISOPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taeniopterygidae	TAENIOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Hemiptera										
Belastomatidae	BELOSTM	0.0	0.4	2.2	0.0	0.0	0.0	0.0	0.0	4.7
Abedus	ABEDUSS	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corixidae	CORIXID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambrysus	AMBRYSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Notonectidae	NOTONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera										
Corydalus cornutus	CORYCOR	0.0	3.2	0.0	0.0	3.2	0.2	4.8	0.0	0.0
Neohermes filicornis	NEOHERM	0.0	0.0	2.0	2.0	0.0	0.0	2.4	0.0	0.0
Order - Trichoptera										
Brachycentrus	BRACHYC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micrasema	MICRASM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phylloicus	PHYLLOI	0.0	0.0	0.0	0.0	0.0	5.8	30.0	0.0	5.1
Agapetus	AGAPETS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culoptila	CULOPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1
Glossosoma	GLOSSOS	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	7.2	0.0	2.0	0.0	9.6	65.2	9.6	0.4	1.7
Atopsyche	ATPSYCH	0.0	0.0	0.0	0.0	0.0	14.0	0.0	0.0	10.2
Cheumatopsyche	CHEUMAT	0.0	8.0	16.6	1.0	16.0	0.8	1.2	0.0	0.0
Hydropsyche	HYDROPS	115.2	32.0	0.0	0.0	0.0	2.8	0.0	210.0	0.0
Leptonema	LEPTONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptilidae-early instar	HYDTILD	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptila	HYDTILA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
Ithytrichia	ITHYTRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leucotrichia	LEUCOTR	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mayatrichia	MAYATRI	0.0	4.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Neotrichia	NEOTRIC	0.0	0.8	0.0	2.0	9.6	0.0	0.0	0.0	3.4
Ochrotrichia	OCHROTR	14.4	0.0	32.2	0.0	3.2	126.0	0.0	34.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	San Pedro River Basin								
		ARA1	ARA2	BAS1	GOU1	HSC1	RAM1	RED1	SPR1	WAR1
Oxyethira	OXYETHR	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3
Lepidostoma-turret case	LEPTURR	0.0	0.0	0.0	2.0	9.0	2.8	16.8	0.0	10.2
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	0.0	0.0	10.2	5.0	0.0	2.6	0.0	0.0	2.0
Oecetis	OECETIS	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.4	5.1
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	HESPERO	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0
Limnephilus	LIMPHIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marilia	MARILIA	0.0	0.0	22.0	0.0	9.6	0.8	0.0	1.2	0.0
Chimarra	CHIMARR	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	1.7
Wormaldia	WORMALD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	POLYCEN	0.0	0.0	8.0	7.0	0.0	16.8	52.8	2.0	8.5
Polyplectropus	POLYPLE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	5.6	1.2	0.0	0.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	GUMAGAA	0.0	0.0	0.0	4.0	0.0	0.0	2.4	0.0	0.0
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera										
Petrophila	PETROPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Order - Coleoptera										
Dytiscidae	DYTISCD	0.0	2.4	2.2	2.0	3.5	0.0	15.6	5.6	2.7
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	0.0	0.0	0.0	0.0	0.0	22.4	3.6	2.0	3.0
Postelichus	POSTELS	1.0	5.2	0.6	0.0	0.0	0.0	3.6	5.6	0.0
Cleptelmis	CLEPTEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterelmis	HETRLMN	0.0	1.2	0.4	0.0	0.0	19.6	1.2	0.0	0.0
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	MACRELM	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microcylloepus	MICYLEP	131.6	72.8	50.0	5.0	3.2	0.6	0.0	46.0	1.0
Narpus	NARPUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neocylloepus	NEOCYLL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neoelmis	NEOELMS	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0
Optioservus	OPTIOSR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Xenelmis	XENELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	ZAITZEV	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0	32.3
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	San Pedro River Basin								
		ARA1	ARA2	BAS1	GOU1	HSC1	RAM1	RED1	SPR1	WAR1
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	GYRINUS	0.0	0.0	0.0	0.0	0.5	0.0	1.2	1.6	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	0.0	0.4	0.4	0.0	0.0	0.6	0.0	1.2	0.0
Hydrophilidae other	HYDPHIL	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Berosus	BEROSUS	1.0	0.0	0.0	0.0	0.0	0.2	12.0	1.6	0.0
Tropisternus	TROPIST	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Diptera										
Atherix	ATHERIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	14.0	0.0	2.8	0.0	0.0	1.7
Ceratopoginidae	CERTPGD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	CERTPGN	301.6	16.8	63.2	27.0	70.3	4.6	4.8	1.6	14.4
Forcipomylinae	FORCIPO	1.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0
Dixa	DIXAAAA	0.0	0.0	0.2	0.0	0.0	0.0	10.8	0.0	0.0
Dixella	DIXELLA	0.0	2.0	0.0	1.0	0.0	0.4	0.0	0.0	0.0
Meringodixa	MERINGO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.4	0.0
Chelifera	CHELIFR	0.0	0.0	0.0	2.0	0.5	39.2	6.0	0.4	1.7
Clinocera	CLINOCR	0.0	0.0	0.0	2.0	1.0	5.6	0.0	0.0	8.5
Hemerodromia	HEMEROD	7.2	0.0	0.0	0.0	3.2	0.0	1.2	0.0	0.0
Ephydridae	EPHYDRI	7.2	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	MARUINA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Pericoma	PERICOM	0.0	0.0	6.0	0.0	3.2	14.2	7.2	0.0	2.7
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	SIMULII	302.4	86.8	56.0	1759.0	54.6	79.2	175.2	32.0	338.3
Stratiomyiidae	STRATIO	0.0	0.4	0.0	0.0	0.0	33.8	7.2	0.4	3.4
Syrphidae	SYRPHID	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	93.6	3.2	16.6	3.0	6.4	4.6	1.2	26.4	0.0
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Antocha	ANTOCHA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Dicranota	DICRANO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Hesperoconopa	HESPCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	0.0	0.0	30.0	17.0	35.2	5.2	27.6	10.4	91.8
Holorusia	HOLORUS	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Molophilus	MOLOPHL	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.0	0.0	2.8	1.2	0.0	0.0
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.8	0.0
Tipula	TIPULAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7

[redacted]oin[redacted]bra[redacted]bun[redacted]ces [redacted]eferen[redacted] Sites [redacted] Ari[redacted], 1992 (Combined Riffle + Pool, untransformed data)

Taxonomic name	Species Code	San Pedro River Basin								
		ARA1	ARA2	BAS1	GOU1	HSC1	RAM1	RED1	SPR1	WAR1
Family - Chironomidae										
Ablabesmyia	ABLABES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	ALOTANY	3.3	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	APEDILU	39.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.0	0.0	0.0	0.0	0.0	16.8	0.0	0.0	2.7
Brundiniella	BRUNDIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryophaenocladius	BRYOPHN	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chaetocladius	CHAETOC	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	13.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia	CONCHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	6.5	1.7	24.0	6.0	6.7	4.2	36.0	2.4	51.0
Constempellina	CONSTMP	0.0	0.0	18.0	7.0	19.2	0.2	1.2	0.4	0.0
Corynoneura	CORYNON	3.3	0.0	1.0	10.0	0.0	9.0	0.0	0.4	1.7
Cricotopus	CRICOTP	1089.0	6.0	75.6	12.0	0.0	56.8	3.6	12.4	7.1
Cricotopus (Nostococladius)	CRICNOS	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	44.2
Cryptochironomus	CRYPCHR	38.7	10.2	0.0	0.0	0.0	0.0	0.0	6.0	1.0
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	0.0	0.6	0.0	0.0	0.0	120.4	3.6	0.0	0.0
Dicrotendipes	DICRTND	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4
Djalmabatista	DJALMAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	139.2	10.2	25.2	1.0	16.0	199.0	22.8	67.2	3.4
Eukiefferiella/Thienemanniella	EUKTHIE	0.0	0.0	2.4	0.0	12.8	0.0	0.0	0.0	0.0
Eukiefferiella	EUKIELL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	9.9	0.0	0.0	0.0	3.2	1.2	0.0	0.0	3.4
Heterotrissocladius	HETRISS	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	0.0	0.0	0.2	1.0	0.5	0.2	0.0	0.0	0.0
Labrundinia	LABRUND	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Larsia	LARSIAA	0.0	1.1	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Lauterborniella	LAUTERB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Lopescladius	LOPESCL	301.5	80.1	4.4	0.0	19.2	2.2	0.0	14.0	0.0
nr. Lopescladius	NRLOPES	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	0.0	11.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0
nr. Mesocricotopus	MESCRIC	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micropsectra	MICROPS	0.0	0.0	2.0	0.0	0.0	16.8	1.2	0.0	0.0
Microtendipes	MICRTEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanocladius	NANCLDS	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	2.0
Nilotanypus	NILOTAN	38.7	7.0	24.8	31.0	60.8	8.8	7.2	0.0	0.0
Nilothauma	NILOTHA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	San Pedro River Basin								
		ARA1	ARA2	BAS1	GOU1	HSC1	RAM1	RED1	SPR1	WAR1
Orthocladiinae-unknown genus	ORTHCLU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius complex	ORTHCL1	1088.7	40.7	27.8	12.0	10.6	14.4	1.2	0.0	84.9
Orthocladius (Orthocladius)	ORTHCLO	3.3	7.2	1.8	6.0	0.0	0.0	0.0	0.0	1.7
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	240.3	18.8	8.2	19.0	18.0	61.8	26.4	0.8	0.0
Pagastia	PAGASTI	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Parachaetocladius	PRCHAET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	61.2
nr. Parachaetocladius	NRPRCHT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parakiefferiella	PRKIEFF	13.3	1.7	26.0	2.0	0.0	0.0	0.0	0.0	0.0
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	28.8	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Parametriocnemus	PRMETRI	9.9	1.1	12.2	0.0	3.7	0.2	6.0	2.4	0.0
Paraphaenocladius	PRPHAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratanytarsus	PRTANYT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	0.0	0.6	0.6	0.0	22.4	1.6	0.0	0.0	1.0
Parochlus kiefferi	PARKIEF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Pentaneura cf. inconspicua	PENTINC	0.0	0.0	0.0	1.0	4.7	0.2	0.0	32.0	3.0
Pentaneura n. sp.	PENTANN	0.0	0.0	0.2	2.0	0.0	2.8	1.2	4.4	1.7
Phaenopsectra	PHAENOP	19.8	4.5	0.0	0.0	0.0	0.0	0.0	0.0	13.0
Polypedilum	POLYPED	110.8	11.6	15.2	1.0	17.0	0.8	15.6	64.4	16.1
Potthastia	POTTHST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Procladius	PROCLAD	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	6.0
Prodiamesa	PRODIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudochironomus	PSDCHIR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Pseudosmittia	PSDSMIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Psilometriocnemus	PSDMETR	0.0	0.0	2.2	2.0	0.5	0.4	0.0	0.0	0.0
Rheocricotopus	RHEOCRC	9.9	0.0	4.0	2.0	15.4	2.8	21.6	2.0	5.1
Rheopelopia	RHEOPEL	0.0	0.0	6.0	5.0	0.0	0.0	15.6	0.4	0.0
Rheotanytarsus	RHEOTAN	9.9	1.1	9.4	6.0	3.7	3.6	4.8	34.0	7.8
Robackia	ROBACKI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Robackia	NROBACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saetheria	SAETHER	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smittia	SMITTIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	STEMPEL	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	5.1
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	36.2	4.5	0.4	0.0	0.0	0.0	0.0	0.0	20.0
Stilocladius	STILOCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	6.0	1.0	0.0	0.0	0.0	0.0	0.0
Synorthocladius	SYNORTH	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	13.6
Tanytarsus	TANYTAR	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Telopelopia okoboji	TELOPOK	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
Thienemanniella	THIENEL	3.3	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Tvetenia	TVETENI	0.0	1.6	0.0	0.0	0.0	28.0	1.2	0.0	39.1
Xestochironomus	XESTCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	16.4	0.0	0.0	0.0	3.5	3.2	2.4	0.0	2.7

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Upper Gila River Basin													
		BLU1	BLU4	CMB1	COL1	EAG1	EAG3	ETK1	FRY1	GRB1	GRP1	LAN1	MAR1	SFC1	SFR1
Hydra	HYDRAAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria	TURBELL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Nematoda	NEMATOM	0.3	0.0	0.0	0.0	8.4	0.0	2.8	0.0	0.0	0.0	0.4	2.4	4.8	0.4
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	4.8	0.4	7.2	18.0	8.4	1.6	42.0	9.6	3.2	35.5	64.0	44.8	52.0	13.6
Erpobdella	ERPOBDL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossiphonia complanata	GLOSCOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pisidium	PISIDUM	0.0	0.0	0.0	1.8	2.4	0.0	0.0	24.0	4.8	0.0	0.0	6.0	1.0	0.0
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Physella	PHYSELL	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyraulus	GYRAULS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	0.0	0.0	0.0	0.0	3.6	1.6	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orconectes causeyi	ORCONEC	0.0	0.0	0.0	0.0	1.2	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acari	ACARIII	43.8	46.0	170.0	80.7	168.0	25.2	16.0	2.4	13.9	3.3	40.0	36.2	4.0	19.2
Order - Odonata															
Aeshnidae-early instar	AESHNID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	0.0	0.0	0.0	16.8	19.2	1.6	0.1	22.4	4.0	0.0	0.0
Cordulegaster	CORDULG	0.3	0.0	0.0	0.0	0.0	0.0	5.6	3.6	2.4	0.0	0.0	1.2	0.0	0.0
Gomphidae	GOMPHID	0.0	3.2	3.6	7.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.2	0.0	0.0
Libellulidae	LIBELLU	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4
Calopterygidae	CALOPTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Coenagrionidae	COENAGR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Argia	ARGIAAA	0.0	0.0	8.4	0.0	0.0	3.2	14.4	2.4	0.0	0.0	11.2	16.8	0.0	0.0
Enallagma/Ischnura	ENALLAG	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lestidae	LESTIDE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Order - Ephemeroptera															
Baetidae	BAETIDE	320.4	225.2	1031.2	229.6	260.4	60.0	388.0	141.6	135.6	83.2	1128.0	97.8	61.8	301.2
Baetodes	BAETODS	0.0	0.0	0.0	0.0	2.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.6
Caenis	CAENISS	8.1	0.0	2.8	6.9	0.0	0.0	0.0	0.0	0.0	0.0	67.2	163.2	0.0	0.0
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0
Ephemerella	EPHEMER	4.8	0.0	30.8	2.1	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Serratella micheneri	SERRATL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	0.0	0.0	72.8	0.0	0.0	36.4	122.4	29.6	38.5	10.8	76.0	10.0	0.0
Epeorus	EPEORUS	0.0	0.0	30.8	470.4	0.0	1.2	16.8	379.2	111.6	16.1	3.6	140.0	6.2	0.0
Heptagenia/Nixe	HEPTAGN	17.1	1.2	21.2	176.7	28.8	0.0	24.0	19.2	17.6	0.0	28.0	10.2	11.2	0.4

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Upper Gila River Basin													
		BLU1	BLU4	CMB1	COL1	EAG1	EAG3	ETK1	FRY1	GRB1	GRP1	LAN1	MAR1	SFC1	SFR1
Rhithrogena	RHITHRG	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.6
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.2	0.0	0.0
Choroterpes/Thraulodes	CHORTHR	0.0	8.8	48.8	4.2	4.8	4.8	19.6	2.4	0.0	0.0	61.6	0.0	9.6	52.8
Paraleptophlebia	PARALEP	0.0	0.0	0.0	257.6	36.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	132.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	988.8
Isonychia	ISONYCH	0.0	0.0	0.0	0.0	1.2	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6
Ameletus	AMELETS	0.0	0.0	0.8	0.0	12.0	0.0	2.8	30.0	44.0	41.7	6.0	4.0	8.6	0.8
Siphlonurus	SIPHLON	3.6	0.0	0.0	0.9	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptohyphes	LEPTHYP	0.0	0.0	5.6	0.0	0.0	58.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	530.4
Tricorythodes	TRICORY	0.0	22.0	33.6	5.7	0.0	4.0	10.0	2.4	3.6	7.3	11.2	18.6	4.8	40.4
Order - Plecoptera															
Capniidae	CAPNIID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chloroperlidae	CHLRPER	0.0	0.0	0.0	33.6	117.6	0.0	2.8	2.4	0.9	0.0	0.0	0.0	2.0	0.0
Amphinemura	AMPHINM	1.8	0.0	5.6	185.1	12.0	0.0	232.4	69.6	3.2	57.6	63.2	4.0	12.8	0.4
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	PERLODN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Isoperla	ISOPERL	86.4	2.4	14.0	5.9	0.0	0.0	0.0	0.0	8.1	0.3	0.0	2.4	0.0	0.0
Taeniopterygidae	TAENIOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
Order - Hemiptera															
Belastomatidae	BELOSTM	0.0	0.4	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1	5.6	0.6	0.0	0.0
Abedus	ABEDUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corixidae	CORIXID	0.0	0.0	0.0	1.5	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Ambrysus	AMBRYSU	0.0	0.4	30.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
Notonectidae	NOTONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera															
Corydalus cornutus	CORYCOR	9.6	8.4	0.0	0.0	3.6	2.4	0.0	0.0	0.9	0.0	0.0	0.0	0.0	16.8
Neohermes filicornis	NEOHERM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	9.6	0.0
Order - Trichoptera															
Brachycentrus	BRACHYC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micrasema	MICRASM	0.0	0.0	22.4	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Phylloicus	PHYLLOI	2.7	0.4	0.0	4.5	0.0	0.0	42.0	52.8	4.0	3.4	8.4	30.4	10.0	10.4
Agapetus	AGAPETS	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culoptila	CULOPTL	0.0	0.0	0.8	16.8	1.2	0.0	0.0	9.6	0.0	0.0	0.4	0.6	0.0	0.0
Glossosoma	GLOSSOS	0.0	0.0	2.8	0.0	1.2	0.0	0.0	0.0	25.2	0.4	0.0	9.4	0.0	0.0
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	3.6	0.0	142.8	29.1	0.0	0.0	11.2	6.0	0.8	0.0	2.4	9.8	3.0	0.4
Atopsyche	ATPSYCH	0.0	0.0	16.8	67.2	0.0	0.0	16.8	27.6	11.4	3.2	22.4	5.2	3.6	0.0
Cheumatopsyche	CHEUMAT	19.2	4.0	34.4	3.3	64.8	13.2	0.0	0.0	0.0	0.0	0.0	0.6	0.0	4.8
Hydropsyche	HYDROPS	48.0	22.4	44.8	5.6	156.0	96.8	17.6	4.8	111.6	0.2	11.2	8.0	0.0	28.8
Leptonema	LEPTONM	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4
Hydroptilidae-early instar	HYDTILD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptila	HYDTILA	0.0	0.0	2.8	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ithytrichia	ITHYTRI	0.0	0.0	25.2	23.3	0.0	0.0	0.0	0.0	1.8	0.0	0.0	2.4	0.0	0.0
Leucotrichia	LEUCOTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mayatrichia	MAYATRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neotrichia	NEOTRIC	22.5	12.8	2.8	16.8	0.0	0.0	2.8	0.0	0.0	0.1	56.0	2.4	1.6	0.0
Ochrotrichia	OCHROTR	12.0	4.8	0.0	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	16.8

[redacted]roin[redacted]ebra[redacted]bur[redacted]ces[redacted]efer[redacted] Sit[redacted] in Ar[redacted], 1[redacted] (Combined [redacted] + P[redacted], untransformed data)

Taxonomic name	Species Code	Upper Gila River Basin													
		BLU1	BLU4	CMB1	COL1	EAG1	EAG3	ETK1	FRY1	GRB1	GRP1	LAN1	MAR1	SFC1	SFR1
Oxyethira	OXYETHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	16.8	0.0	0.0	0.0
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	5.6	0.0	0.0	0.0	4.8	0.0	25.6	0.0	0.0	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	0.0	0.0	0.0	0.0	0.0	266.0	3.6	0.9	1.1	0.0	0.0	2.0	0.0
Lepidostoma-turret case	LEPTURR	6.9	0.0	2.8	10.2	50.4	0.0	0.0	2.4	14.4	4.8	42.4	28.6	366.2	8.4
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0	11.2	7.2	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	2.4	8.0	94.0	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
Oecetis	OECETIS	5.4	0.0	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.6	0.0	4.0
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	2.8	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	HESPERO	0.0	0.0	5.6	0.0	2.4	0.0	0.0	13.2	2.4	0.1	1.2	0.0	1.0	0.0
Limnephilus	LIMPHIL	0.0	0.0	0.0	0.6	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marilia	MARILIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chimarra	CHIMARR	0.0	0.0	8.4	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wormaldia	WORMALD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	POLYCEN	1.2	0.0	2.4	5.6	24.0	0.0	14.0	8.4	40.8	3.3	0.0	4.6	16.6	0.4
Polyplectropus	POLYPLE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	GUMAGAA	0.0	0.0	75.6	21.8	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera															
Petrophila	PETROPH	0.0	1.2	11.2	0.0	0.0	2.4	0.4	0.0	0.9	0.0	0.0	0.6	0.0	0.0
Order - Coleoptera															
Dytiscidae	DYTISCD	0.0	0.0	0.0	0.0	2.4	0.0	0.0	6.0	3.2	3.2	0.0	4.0	0.0	0.0
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	0.0	0.0	11.2	0.3	1.2	0.0	0.0	1.2	0.0	0.0	5.6	3.6	0.0	0.0
Postelichus	POSTELS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Cleptelmis	CLEPTEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterelmis	HETRLMN	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Macrelmis	MACRELM	0.0	9.6	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
Microcylloepus	MICYLEP	345.6	46.8	203.2	3.0	2.4	7.2	3.2	0.0	1.8	0.0	0.8	0.0	0.0	33.6
Narpus	NARPUSS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.8	0.0	0.0	0.6	0.0	0.0
Neocylloepus	NEOCYLL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
Neoelmis	NEOELMS	2.4	7.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
Optioservus	OPTIOSR	7.2	0.0	369.6	690.1	28.8	0.0	5.6	1.2	6.1	0.1	11.2	13.2	1.6	0.0
Xenelmis	XENELMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	ZAITZEV	2.7	0.0	0.0	845.6	72.0	0.0	165.2	13.2	0.9	0.0	0.0	12.0	3.6	0.0
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Upper Gila River Basin													
		BLU1	BLU4	CMB1	COL1	EAG1	EAG3	ETK1	FRY1	GRB1	GRP1	LAN1	MAR1	SFC1	SFR1
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	GYRINUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrophilidae other	HYDPHIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Berosus	BEROSUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tropisternus	TROPIST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	2.4	0.0	0.0	39.2	21.6	15.6	4.8	0.0	0.0	0.1	0.0	2.4	0.0	0.0
Order - Diptera															
Atherix	ATHERIX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	0.0	0.0	0.0	11.2	38.4	0.8	16.0	0.4	28.0	0.0	0.0
Ceratopoginidae	CERTPGD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	CERTPGN	12.9	11.6	20.0	3.9	19.2	0.0	0.4	6.0	8.4	11.8	596.8	36.6	3.6	11.6
Forcipomyiinae	FORCIPO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	1.0	0.0
Dixa	DIXAAAA	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.8	0.0	0.0	1.2	0.0	0.0
Dixella	DIXELLA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Meringodixa	MERINGO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.4	0.0	3.3	0.0	0.6	0.0	0.0
Chelifera	CHELIFR	2.4	0.0	0.0	5.6	2.4	0.0	5.6	2.4	27.0	6.4	61.6	21.8	6.2	0.0
Clinocera	CLINOCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	1.6	0.0
Hemerodromia	HEMEROD	0.0	0.4	0.0	0.0	2.4	0.0	0.0	0.0	1.8	0.0	28.0	1.2	0.0	0.0
Ephydridae	EPHYDRI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	MARUINA	24.6	0.8	19.6	0.0	3.6	1.2	0.0	0.0	4.5	0.0	0.0	4.0	0.0	0.0
Pericoma	PERICOM	0.0	0.0	14.0	0.3	0.0	0.0	16.8	8.4	3.2	0.0	45.2	9.6	61.0	0.4
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	SIMULII	54.6	123.2	112.0	5.6	21.6	20.8	451.2	2661.6	18.5	1833.7	278.8	1892.0	272.4	343.6
Stratiomyiidae	STRATIO	2.4	1.2	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.1	0.0	0.0	0.0	0.0
Syrphidae	SYRPHID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	9.6	2.8	11.2	12.4	0.0	1.2	0.8	0.0	7.2	0.8	11.2	0.0	0.0	0.0
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antocha	ANTOCHA	0.0	0.4	8.4	0.3	0.0	0.0	5.6	0.0	0.0	0.0	5.6	0.6	0.0	0.0
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Dicranota	DICRANO	0.3	0.0	0.0	0.0	0.0	0.0	8.4	3.6	0.0	3.3	5.6	0.0	3.0	0.0
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0
Hesperoconopa	HESPCON	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	11.1	4.8	32.4	4.8	14.4	1.2	177.2	6.0	12.2	0.0	22.4	7.8	1.0	5.6
Holorusia	HOLORUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Molophilus	MOLOPHL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	1.2
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	TIPULAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.8	0.0	11.2	5.2	0.0	0.0

[redacted]roin[redacted]ebra[redacted]oun[redacted]ces [redacted]efer[redacted] Sit[redacted] Ari[redacted], 1[redacted] (Com[redacted]ed [redacted]+P[redacted], untransformed data)

Taxonomic name	Species Code	Upper Gila River Basin													
		BLU1	BLU4	CMB1	COL1	EAG1	EAG3	ETK1	FRY1	GRB1	GRP1	LAN1	MAR1	SFC1	SFR1
Family - Chironomidae															
Ablabesmyia	ABLABES	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.1	0.0	1.2	0.0	3.2
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	ALOTANY	0.0	0.0	0.0	0.0	21.6	0.0	0.0	40.8	1.6	0.0	0.4	0.0	4.0	0.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	APEDILU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.5	0.0	0.0	0.0	0.0	0.0	2.8	55.2	1.8	0.0	5.6	0.0	12.2	0.4
Brundiniella	BRUNDIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryophaenocladius	BRYOPHN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.8	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	0.0	0.0	0.0	0.0	0.0	8.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.4
Chaetocladius	CHAETOC	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	1.2	0.0	0.3	0.0	0.0	2.0	0.0	0.0	0.0	0.4	0.0	0.0	3.6
Conchapelopia	CONCHAP	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	28.4	0.0	18.4	2.4	136.8	0.0	0.0	0.0	10.5	0.7	11.6	7.8	24.2	16.8
Constempellina	CONSTMP	0.5	0.0	0.0	341.6	240.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corynoneura	CORYNON	2.9	0.0	0.0	0.0	2.4	0.0	0.8	2.4	0.0	0.0	5.6	8.4	1.0	1.2
Cricotopus	CRICOTP	1.8	0.0	2.8	0.0	2.4	6.4	3.2	2.4	0.8	0.0	5.6	5.8	11.0	7.6
Cricotopus (Nostococladius)	CRICNOS	0.0	0.0	0.0	0.0	0.0	0.0	358.4	12.0	0.0	0.1	0.4	26.4	0.0	0.0
Cryptochironomus	CRYPCHR	0.0	0.0	0.0	0.3	0.0	0.0	0.8	2.4	0.0	0.0	0.0	0.6	0.0	12.4
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Dicrotendipes	DICRTND	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Djalmabatista	DJALMAB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	24.5	0.4	46.4	17.4	13.2	8.0	22.4	21.6	5.2	0.1	57.2	4.6	5.8	8.0
Eukiefferiella/Thienemanniella	EUKTHIE	9.6	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0
Eukiefferiella	EUKIELL	0.0	0.4	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	2.3	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	1.9	89.6	3.0	4.2	2.8
Heterotrissocladius	HETRISS	0.9	0.0	0.0	0.0	24.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0
Labrundinia	LABRUND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Larsia	LARSIAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lauterborniella	LAUTERB	0.0	0.0	0.0	17.7	43.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lopescladius	LOPESCL	0.0	0.4	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	1.6	50.4
nr. Lopescladius	NRLOPES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Mesocricotopus	MESCRIC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Micropsectra	MICROPS	8.6	0.0	0.0	0.0	0.0	0.0	0.0	45.6	2.4	0.1	6.0	0.0	36.4	5.2
Microtendipes	MICRTEN	0.5	0.0	0.8	5.6	13.2	8.4	25.6	43.2	36.0	0.0	0.0	4.6	56.0	0.0
Nanocladius	NANCLDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nilotanypus	NILOTAN	0.0	0.4	5.6	12.7	7.2	0.0	0.0	4.8	0.0	0.0	84.0	6.0	0.0	2.4
Nilothauma	NILOTHA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Upper Gila River Basin													
		BLU1	BLU4	CMB1	COL1	EAG1	EAG3	ETK1	FRY1	GRB1	GRP1	LAN1	MAR1	SFC1	SFR1
Orthocladiinae-unknown genus	ORTHCLU	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius complex	ORTHCL1	2.3	1.2	33.6	0.6	2.4	9.6	3.2	0.0	1.6	3.2	28.8	5.8	12.4	0.8
Orthocladius (Orthocladius)	ORTHCLO	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	0.0	0.0	39.2	0.3	0.0	0.0	19.6	9.6	4.0	12.8	0.4	12.0	8.0	3.6
Pagastia	PAGASTI	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Parachaetocladius	PRCHAET	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	3.2
nr. Parachaetocladius	NRPRCHT	0.9	0.0	0.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0
Paraklefferiella	PRKIEFF	0.5	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.6	0.0	0.4
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parametriocnemus	PRMETRI	0.5	0.0	5.6	5.6	8.4	3.2	2.0	0.0	3.6	10.5	5.6	0.0	0.0	0.0
Paraphaenocladius	PRPHAEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Paratanytarsus	PRTANYT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	2.4	1.2	0.8	0.3	0.0	0.0	0.8	0.0	0.0	0.4	0.8	0.0	1.0	0.8
Parochlus kiefferi	PARKIEF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pentaneura cf. inconspicua	PENTINC	0.0	0.0	4.4	0.3	0.0	0.0	0.0	0.0	3.3	0.4	11.2	2.4	6.0	1.6
Pentaneura n. sp.	PENTANN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2	0.6	0.0	0.0
Phaenopsectra	PHAENOP	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polypedilum	POLYPED	1.8	0.4	72.8	0.6	78.0	41.6	4.0	4.8	0.8	0.5	90.8	6.0	1.6	132.8
Potthastia	POTTHST	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	1.8	0.0	0.0
Procladius	PROCLAD	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prodiamesa	PRODIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudochironomus	PSDCHIR	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Pseudosmittia	PSDSMIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psilometriocnemus	PSDMETR	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	5.2
Rheocricotopus	RHEOCRC	6.3	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.8	0.0	56.4	1.8	5.0	0.4
Rheopelopia	RHEOPEL	0.5	0.0	0.0	11.2	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.6	2.0	0.8
Rheotanytarsus	RHEOTAN	0.0	0.0	0.0	0.0	8.4	1.6	16.8	2.4	0.0	3.2	0.0	0.0	0.0	0.0
Robackia	ROBACKI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
nr. Robackia	NROBACK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saetheria	SAETHER	0.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4
Smittia	SMITTIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	STEMPEL	29.4	0.0	6.4	0.6	4.8	0.0	0.0	21.6	8.8	16.0	140.8	48.6	12.4	20.4
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stilocladius	STILOCL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	2.8	22.4	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0
Synorthocladius	SYNORTH	0.5	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	5.6	2.4	0.0	0.0
Tanytarsus	TANYTAR	1.4	0.0	0.8	0.3	7.2	1.6	0.0	2.4	2.4	25.7	22.4	8.0	12.8	4.0
Telopelopia okoboji	TELOPOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	THIENEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0	0.4
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Tvetenia	TVETENI	2.4	0.0	44.8	0.6	2.4	0.0	14.0	19.2	0.0	0.0	62.0	4.0	22.4	0.0
Xestochironomus	XESTCHR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	12.6	0.0	0.8	0.0	52.8	0.0	0.0	26.4	5.6	0.2	2.8	0.6	1.6	6.8

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Upper Salt River Basin					
		EFB1	WFB1	NBW1	CKN1	HOR1	RES1
Hydra	HYDRAAA	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria	TURBELL	0.0	1.6	0.0	0.0	0.0	0.0
Nematoda	NEMATOM	0.0	2.8	7.2	0.0	0.0	3.3
Nematomorpha	NEMAMOR	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	OLIGOCH	1.2	6.4	46.4	0.0	0.0	2.8
Erpobdella	ERPOBDL	0.0	8.8	1.2	0.0	0.0	0.0
Glossiphonia complanata	GLOSCOM	0.0	0.0	1.2	0.0	0.0	0.0
Helobdella stagnalis	HELOBST	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	PELECYP	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	CORBICU	0.0	0.0	0.0	0.0	0.0	0.0
Sphaeriidae	SPHAERD	0.0	0.0	0.0	0.0	0.0	3.6
Pisidium	PISIDUM	0.0	4.8	24.3	0.0	15.6	10.8
Ferrissia	FERRISS	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	PYRGULP	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	TRYONIA	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	FOSSARI	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	RADIXAU	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	STAGNIC	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	PSEUDSU	0.0	3.2	0.0	0.0	0.0	0.0
Physella	PHYSELL	0.0	1.6	0.0	0.0	0.0	0.0
Gyraulus	GYRAULS	0.0	17.6	0.0	0.0	0.0	0.0
Menetus	MENETUS	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	PLANORB	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	VALVHUM	14.4	1.6	0.0	0.0	0.0	0.0
Ostracoda	OSTRACD	0.0	6.4	0.0	0.0	16.8	8.3
Gammarus	GAMMARS	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	HYALAZT	0.0	0.0	0.0	0.0	0.0	0.0
Orconectes causeyi	ORCONEC	0.0	0.0	0.0	0.0	0.0	0.0
Acari	ACARIII	57.6	464.4	74.0	114.6	128.4	64.7
Order - Odonata							
Aeshnidae-early instar	AESHNID	0.0	0.0	0.0	0.0	0.0	0.0
Anax junius	ANAXJUN	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	OPLONAE	0.0	0.0	0.0	11.2	0.0	0.0
Cordulegaster	CORDULG	0.0	0.0	0.0	0.0	0.0	0.0
Gomphidae	GOMPHID	5.2	0.0	0.0	0.0	0.0	0.0
Libellulidae	LIBELLU	0.4	0.0	0.0	0.0	0.0	0.0
Calopterygidae	CALOPTR	0.0	0.0	0.0	0.0	0.0	0.0
Coenagrionidae	COENAGR	0.0	0.0	0.0	0.0	2.4	0.0
Argia	ARGIAAA	0.0	0.0	0.0	5.6	0.0	0.0
Enallagma/Ischnura	ENALLAG	1.2	0.0	0.0	0.0	0.0	0.0
Lestidae	LESTIDE	0.0	0.0	0.0	0.0	0.0	0.0
Order - Ephemeroptera							
Baetidae	BAETIDE	241.6	560.0	256.4	289.0	2684.4	285.2
Baetodes	BAETODS	0.0	2.8	0.0	0.0	0.0	0.0
Caenis	CAENISS	0.0	0.0	0.0	0.0	0.0	0.0
Drunella coloradensis/flavilinea	DRUNCFL	0.0	0.0	0.0	1.0	0.0	0.0
Drunella doddsi	DRUNDOD	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	DRUNGRD	0.0	0.0	6.0	0.0	0.0	0.0
Ephemerella	EPHEMER	100.8	133.2	14.4	0.0	0.0	0.0
Serratella micheneri	SERRATL	0.0	0.0	0.0	0.0	0.0	0.0
Cinygmula	CINYGML	0.0	8.4	20.0	5.0	144.0	3.6
Epeorus	EPEORUS	0.0	25.2	88.0	8.0	6.0	48.6
Heptagenia/Nixe	HEPTAGN	4.8	227.2	16.8	84.0	1.2	151.2

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Upper Salt River Basin					
		EFB1	WFB1	NBW1	CKN1	HOR1	RES1
Rhithrogena	RHITHRG	1.6	0.0	0.0	0.0	0.0	0.0
Stenonema	STENONM	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	LEPTOPH	0.0	0.0	0.0	0.0	0.0	0.0
Choroterpes/Thraulodes	CHORTHR	17.6	0.0	0.0	0.0	0.0	3.6
Paraleptophlebia	PARALEP	0.0	16.8	12.0	40.0	0.0	12.6
Traverella	TRAVERL	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	ISONYCH	0.4	0.0	0.0	0.0	0.0	0.0
Ameletus	AMELETS	0.0	0.0	1.2	7.0	44.4	28.8
Siphlonurus	SIPHLON	0.0	0.0	0.0	0.0	0.0	0.0
Leptohyphes	LEPTHYP	8.4	1.6	0.0	0.0	0.0	0.5
Tricorythodes	TRICORY	36.4	26.8	6.0	5.6	8.4	5.4
Order - Plecoptera							
Capniidae	CAPNIID	0.0	0.0	0.0	0.0	0.0	0.0
Chloroperlidae	CHLRPER	0.0	5.6	12.0	75.8	33.6	7.1
Amphinemura	AMPHINM	19.2	56.0	62.8	385.6	380.4	52.4
Zapada cinctipes	ZAPCINC	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	ZAPCOLM	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	CLAASAB	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	HESPERL	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	PERLODN	0.0	5.6	0.0	0.0	0.0	0.0
Isoperla	ISOPERL	0.0	0.0	0.0	11.2	0.0	0.0
Taeniopterygidae	TAENIOP	0.0	0.0	0.0	0.0	0.0	0.0
Order - Hemiptera							
Belastomatidae	BELOSTM	0.0	0.0	0.0	0.0	0.0	0.0
Abedus	ABEDUSS	0.0	0.0	0.0	0.0	0.0	0.0
Corixidae	CORIXID	0.0	6.4	4.8	0.0	0.0	0.0
Ambrysus	AMBRYSU	0.8	52.4	3.6	11.2	1.2	12.6
Notonectidae	NOTONEC	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera							
Corydalus cornutus	CORYCOR	0.4	0.0	0.0	0.0	0.0	0.0
Neohermes filicornis	NEOHERM	0.0	0.0	0.0	0.0	0.0	0.0
Order - Trichoptera							
Brachycentrus	BRACHYC	724.8	174.4	0.0	0.0	0.0	7.2
Micrasema	MICRASM	0.0	19.6	3.2	0.0	0.0	1.8
Phylloicus	PHYLLOI	0.0	3.2	0.0	0.0	1.2	1.8
Agapetus	AGAPETS	0.0	0.0	0.0	0.0	0.0	23.4
Culoptila	CULOPTL	0.0	14.0	1.2	0.0	0.0	86.4
Glossosoma	GLOSSOS	0.0	2.8	0.0	0.0	0.0	1.8
Protoptila	PROTOPT	0.0	0.0	0.0	0.0	0.0	0.0
Helicopsyche	HELICOP	0.0	50.8	6.0	5.6	0.0	0.0
Atopsyche	ATPSYCH	0.0	0.0	4.0	8.6	6.0	9.0
Cheumatopsyche	CHEUMAT	0.4	2.8	2.4	0.0	0.0	0.0
Hydropsyche	HYDROPS	0.0	30.8	49.6	7.6	6.0	14.4
Leptonema	LEPTONM	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptilidae-early instar	HYDTILD	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptila	HYDTILA	0.0	0.0	0.0	1.0	0.0	0.0
Ithytrichia	ITHYTRI	0.0	4.4	0.0	0.0	0.0	3.6
Leucotrichia	LEUCOTR	0.0	0.0	0.0	0.0	0.0	0.0
Mayatrichia	MAYATRI	0.0	0.0	0.0	0.0	0.0	0.0
Neotrichia	NEOTRIC	0.0	0.0	2.0	5.6	0.0	19.8
Ochrotrichia	OCHROTR	0.0	0.0	8.0	11.2	0.0	0.0

[redacted]oin[redacted]bra[redacted]bun[redacted]es [redacted]fer[redacted] Sit[redacted] Ari[redacted], 19[redacted] (Cor[redacted]ed [redacted] + P[redacted], untr[redacted]ormed data) [redacted]

Taxonomic name	Species Code	Upper Salt River Basin					
		EFB1	WFB1	NBW1	CKN1	HOR1	RES1
Oxyethira	OXYETHR	0.0	0.0	0.0	5.6	0.0	0.0
Zumatrichia	ZUMATRI	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	LEPINST	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-sand case	LEPSAND	0.0	2.8	6.0	0.0	0.0	1.8
Lepidostoma-turret case	LEPTURR	0.0	2.8	35.2	72.0	27.6	33.2
Lepidostoma acarolum-larvae	LEPACAR	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma ormeum-pupae	LEPORME	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	LEPTOCR	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	NECTOCR	5.2	3.2	12.0	0.0	0.0	0.0
Oecetis	OECETIS	0.0	2.8	0.0	0.0	0.0	0.0
Triaenodes	TRIAENO	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	LIMNEPH	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	APATANI	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	DICOSMO	0.0	0.0	0.0	0.0	0.0	0.0
Eocosmoecus	EOCOSMO	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	HESPERO	4.8	0.0	3.2	6.0	0.0	0.5
Limnephilus	LIMPHIL	0.0	0.0	0.0	0.0	0.0	0.0
Onocosmoecus unicolor	ONOCOSM	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	PSYCHOG	0.0	0.0	0.0	3.0	18.0	10.5
Marilia	MARILIA	0.0	2.8	0.0	0.0	0.0	1.8
Chimarra	CHIMARR	0.0	0.0	0.0	0.0	0.0	0.0
Wormaldia	WORMALD	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	POLYCEN	0.4	0.0	0.0	5.6	3.6	0.0
Polyplectropus	POLYPLE	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	TINODES	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila	RHYCOPH	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	RHYANGL	0.0	0.0	4.0	24.4	0.0	0.0
Rhyacophila Coloradensis Group	RHYCOLR	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	GUMAGAA	0.0	8.4	48.8	0.0	12.0	0.0
Oligophlebodes	OLIGPHL	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera							
Petrophila	PETROPH	4.8	20.8	1.2	0.0	0.0	0.0
Order - Coleoptera							
Dytiscidae	DYTISCD	0.0	0.0	0.0	0.0	12.0	1.5
Deronectes/Oreodytes	DERONEC	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	DYTISCS	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	DRYOPID	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	HELICHS	0.4	2.8	0.0	0.0	0.0	0.0
Postelichus	POSTELS	0.4	0.0	0.0	0.0	0.0	0.0
Cleptelmis	CLEPTEL	0.0	0.0	1.2	0.0	0.0	0.0
Cylloepus	CYLLOEP	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	DUBIRPH	0.0	1.6	0.0	0.0	0.0	0.0
Heterelmis	HETRLMN	0.0	0.0	0.0	0.0	0.0	1.8
Heterlimnius larvae	HTLNIUS	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	MACRELM	0.4	0.0	0.0	0.0	0.0	0.0
Microcylloepus	MICYLEP	36.4	89.6	0.0	0.0	0.0	0.0
Narpus	NARPUSS	0.0	0.0	1.2	19.8	1.2	1.8
Neocylloepus	NEOCYLL	0.0	0.0	0.0	0.0	0.0	0.0
Neoelmis	NEOELMS	0.0	0.0	0.0	0.0	0.0	0.0
Optioservus	OPTIOSR	14.4	189.2	95.6	269.8	64.8	345.6
Xenelmis	XENELMS	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	ZAITZEV	4.8	28.4	32.0	164.8	61.2	142.4
Dineutus-adult	DINEUTS	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Upper Salt River Basin					
		EFB1	WFB1	NBW1	CKN1	HOR1	RES1
Gyretes-larvae	GYRETES	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	GYRINUS	0.0	0.0	0.0	0.0	0.0	0.0
Haliplus-larvae	HALIPLS	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	PELTODY	0.0	0.0	0.0	0.0	0.0	0.0
Hydrophilidae other	HYDPHIL	0.0	2.8	0.0	0.0	0.0	0.0
Berosus	BEROSUS	0.0	0.0	0.0	0.0	0.0	0.0
Tropisternus	TROPIST	0.0	0.0	0.0	0.0	0.0	0.0
Hydroscapha natans	HYDSCNT	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	LUTROCH	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	NOTERID	0.0	0.0	0.0	0.0	0.0	0.0
Psephenus-larvae	PSEPHEN	0.4	3.2	2.0	92.6	28.8	30.6
Order - Diptera							
Atherix	ATHERIX	14.4	14.4	0.0	0.0	0.0	3.6
Agathon arizonicus	AGATHAZ	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopoginidae	CERTPGD	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	CERTPGN	2.0	14.0	9.6	8.6	9.6	20.8
Forcipomyilnae	FORCIPO	0.0	0.0	0.0	0.0	6.0	0.5
Dixa	DIXAAAA	0.0	0.0	0.0	0.0	0.0	0.5
Dixella	DIXELLA	0.0	0.0	0.0	0.0	0.0	0.0
Meringodixa	MERINGO	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	DOLICHP	0.0	0.0	2.0	0.0	0.0	0.0
Chelifera	CHELIFR	4.8	3.2	1.2	22.4	8.4	2.3
Clinocera	CLINOCR	0.0	0.0	0.0	1.0	0.0	0.0
Hemerodromia	HEMEROD	0.0	1.6	0.0	0.0	0.0	5.4
Ephydridae	EPHYDRI	0.0	0.0	0.0	0.0	0.0	0.0
Limnophora	LIMPHOR	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	MARUINA	4.8	16.8	0.0	0.0	0.0	10.8
Pericoma	PERICOM	0.0	0.0	0.0	0.0	0.0	0.0
Ptychoptera	PTYCHOP	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	SIMULII	539.2	41.6	40.4	526.4	169.2	60.4
Stratiomyiidae	STRATIO	0.0	1.6	0.0	0.0	0.0	0.0
Syrphidae	SYRPHID	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	TABANID	10.0	8.0	3.6	0.0	1.2	5.4
Tanyderidae	TANYDER	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	THAUMAL	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	TIPULID	0.0	0.0	0.0	0.0	0.0	0.0
Antocha	ANTOCHA	4.8	4.4	24.0	12.6	0.0	12.6
Cryptolabis	CRYPTOL	0.0	0.0	0.0	0.0	0.0	0.0
Dicranota	DICRANO	0.0	2.8	0.0	0.0	1.2	5.4
Erioptera (Mesocyphona)	ERIOPTE	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	GONOMYI	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoconopa	HESPCON	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	HEXATOM	0.0	19.6	13.2	27.8	15.6	35.1
Holorusia	HOLORUS	0.0	0.0	0.0	0.0	0.0	0.0
Limonia	LIMONIA	0.0	0.0	0.0	0.0	0.0	0.0
Molophilus	MOLOPHL	0.0	0.0	0.0	0.0	0.0	0.0
Orimarga	ORIMARG	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	PARADEL	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	PEDICIA	0.0	0.0	0.0	0.0	0.0	1.8
Rhabdomastix	PHABDOM	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	TIPULAA	9.6	4.8	0.0	5.6	0.0	0.0

[redacted]oin[redacted]bra[redacted]bun[redacted]es [redacted]fer[redacted] Sit[redacted] Ari[redacted], 19[redacted] (Co[redacted] + P[redacted], untransformed data)

Taxonomic name	Species Code	Upper Salt River Basin					
		EFB1	WFB1	NBW1	CKN1	HOR1	RES1
Family - Chironomidae							
Ablabesmyia	ABLABES	0.0	0.0	0.0	0.0	2.4	0.0
Acamptocladius	ACAMPTO	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	ALOTANY	0.0	0.0	0.0	2.5	0.0	0.0
Antillocladius	ANTILLO	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	APEDILU	0.0	0.0	4.8	0.0	0.0	0.0
Boreochlus	BOREOCH	0.0	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	BOREOHP	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	NRBOREO	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	BRILLIA	0.0	0.0	0.0	0.0	0.0	0.0
Brundiniella	BRUNDIN	0.0	0.0	0.0	0.0	0.0	1.0
Bryophaenocladius	BRYOPHN	0.0	0.0	0.0	0.0	0.0	0.0
Camptocladius	CAMPTCL	0.0	0.0	0.0	0.0	0.0	0.0
Cardiocladius	CARDIOC	0.0	1.6	0.0	0.0	0.0	0.0
Chaetocladius	CHAETOC	0.0	0.0	0.0	0.0	0.0	0.0
Chironomus	CHIRNMS	0.0	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	CLADTNY	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia	CONCHAP	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	CONTHIE	0.0	3.6	15.6	66.4	117.9	1.8
Constempellina	CONSTMP	0.0	2.8	62.0	192.2	83.1	3.5
Corynoneura	CORYNON	0.0	0.0	0.0	0.0	6.0	0.0
Cricotopus	CRICOTP	4.8	10.4	0.0	24.9	4.8	0.0
Cricotopus (Nostococladius)	CRICNOS	0.0	22.4	33.2	25.4	4.8	14.4
Cryptochironomus	CRYPCHR	0.0	0.0	1.2	0.0	0.0	0.0
Cryptotendipes	CRYPTND	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	DEMCRYP	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	DIAMESA	0.0	0.0	0.0	0.0	0.0	0.0
Dicrotendipes	DICRTND	0.0	0.0	0.0	0.0	0.0	0.0
Djalmabatista	DJALMAB	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	EUKIEFF	28.8	0.8	24.0	159.3	22.8	2.3
Eukiefferiella/Thienemanniella	EUKTHIE	0.0	0.0	3.2	0.0	0.0	0.0
Eukiefferiella	EUKIELL	0.0	0.0	0.0	0.0	0.0	0.0
Euryhapsis	EURYHAP	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	GLYPTOT	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	GOELDCH	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	HELENIE	0.0	0.0	3.6	0.0	0.0	0.0
Heterotrissocladius	HETRISS	0.0	0.0	0.0	0.0	0.0	0.0
nr. Heterotrissocladius	NRHETRS	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	HYDBAEN	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	HYPHYGM	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	KRENPEL	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	KRENSMT	0.0	0.0	0.0	0.0	0.0	0.0
Labrundinia	LABRUND	0.0	0.0	2.4	0.0	0.0	0.0
Larsia	LARSIAA	0.0	0.0	0.0	0.0	0.0	0.0
Lauterborniella	LAUTERB	0.0	434.4	87.6	105.0	114.3	124.2
Lopescladius	LOPESCL	0.4	0.0	0.0	9.0	0.0	0.0
nr. Lopescladius	NRLOPES	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	LIMPHYH	0.0	0.0	0.0	0.0	2.4	0.0
nr. Mesocricotopus	MESCRIC	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	MESMITT	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	METRIOC	0.0	0.0	0.0	0.0	0.0	0.0
Micropsectra	MICROPS	4.8	0.8	40.8	0.0	0.0	0.0
Microtendipes	MICRTEN	0.0	5.6	6.0	0.0	4.8	0.0
Nanocladius	NANCLDS	0.0	0.0	0.0	0.0	0.0	1.8
Nilotanypus	NILOTAN	0.0	0.0	3.6	11.2	14.1	5.4
Nilothauma	NILOTHA	0.0	0.0	0.0	0.0	0.0	0.0
Odontomesa	ODONTOM	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Species Code	Upper Salt River Basin					
		EFB1	WFB1	NBW1	CKN1	HOR1	RES1
Orthocladiinae-unknown genus	ORTHCLU	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius complex	ORTHCL1	0.0	12.8	1.2	61.6	24.9	1.0
Orthocladius (Orthocladius)	ORTHCLO	4.8	0.0	0.0	0.0	0.0	1.8
Orthocladius (Symposiocladius)	ORTHCLS	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	ORTHCLE	0.0	0.0	0.0	39.2	14.1	1.8
Pagastia	PAGASTI	0.0	9.6	0.0	5.6	0.0	0.0
Parachaetocladius	PRCHAET	0.0	0.0	0.0	5.6	0.0	0.0
nr. Parachaetocladius	NRPRCHT	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	PRCHIRN	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	PRCLADP	0.0	0.0	1.2	0.0	0.0	0.0
Parakiefferiella	PRKIEFF	4.8	1.6	0.0	0.0	0.0	0.0
Paralauterborniella	PRLAUTR	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	PRMERIN	0.0	0.0	0.0	0.0	0.0	0.0
Parametriocnemus	PRMETRI	9.6	0.8	0.0	0.0	12.0	0.0
Paraphaenocladius	PRPHAEN	0.0	0.8	0.0	0.0	0.0	0.0
Paratanytarsus	PRTANYT	0.0	2.8	0.0	0.0	0.0	0.0
Paratendipes	PRTENDP	0.0	0.0	21.6	0.0	2.4	0.0
Parochlus kiefferi	PARKIEF	0.0	0.0	0.0	0.0	0.0	0.0
Pentaneura cf. inconspicua	PENTINC	0.0	0.8	0.0	0.0	2.4	3.6
Pentaneura n. sp.	PENTANN	0.0	0.0	0.0	0.0	2.4	0.0
Phaenopsectra	PHAENOP	0.0	0.0	0.0	0.0	0.0	0.0
Polypedilum	POLYPED	8.0	4.0	8.4	0.0	6.9	0.0
Potthastia	POTTHST	4.8	12.8	0.0	5.6	4.8	0.0
Procladius	PROCLAD	0.0	0.0	0.0	0.0	0.0	0.0
Prodiamesa	PRODIAM	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	PSECTRO	0.0	0.0	0.0	0.0	0.0	0.0
Pseudochironomus	PSDCHIR	14.4	14.4	0.0	0.0	0.0	0.0
Pseudodiamesa	PSDDIAM	0.0	0.0	0.0	0.0	0.0	0.5
Pseudorthocladius	PSDORTH	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosmittia	PSDSMIT	0.0	0.0	0.0	0.0	0.0	0.0
Psilometriocnemus	PSDMETR	0.0	2.8	1.2	0.0	0.0	0.5
Rheocricotopus	RHEOCRC	0.0	0.0	0.0	0.0	0.0	0.0
Rheopelopia	RHEOPEL	0.0	0.0	0.0	11.2	0.0	0.0
Rheotanytarsus	RHEOTAN	0.0	0.0	1.2	0.0	2.4	0.0
Robackia	ROBACKI	0.8	0.0	0.0	0.0	0.0	0.0
nr. Robackia	NROBACK	0.0	0.0	1.2	0.0	0.0	0.0
Saetheria	SAETHER	1.2	0.0	0.0	0.0	0.0	0.0
Smittia	SMITTIA	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	STEMPEL	4.8	30.8	31.2	0.0	0.0	0.0
Stempellina	STEMPIN	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	STENOCH	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	STICTOC	0.0	0.0	3.6	0.0	0.0	0.0
Stilocladius	STILOCL	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	SUBLETT	0.0	0.8	0.0	0.0	0.0	0.0
Symbiocladius	SYMBCLD	0.0	0.0	0.0	9.0	2.4	0.0
Synorthocladius	SYNORTH	0.0	4.0	0.0	0.0	0.0	0.0
Tanytarsus	TANYTAR	0.0	5.6	12.0	0.0	0.0	0.0
Telopelopia okoboji	TELOPOK	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	THIENEL	0.0	1.6	0.0	5.6	0.0	0.0
Thienemannimyia	THIENMY	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	THIENBR	0.0	0.0	0.0	0.0	0.0	0.0
Tvetenia	TVETENI	28.8	1.6	0.0	11.2	0.0	0.0
Xestochironomus	XESTCHR	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	ZAVRLMY	0.0	0.0	0.0	0.0	4.8	6.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Verde River Basin														Yaqui Ba
	BLC1	EVD1	EVD3	OAK1	PIN1	ROU1	SYH1	SYM1	WBV1	WCC1	WCC3	WEB1	WFO1	VER1	RUC1
Hydra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria	0.0	3.2	0.0	0.4	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Nematoda	0.4	0.0	0.0	0.0	0.0	1.2	0.3	1.6	4.8	0.0	2.0	2.6	1.6	4.8	0.3
Nematomorpha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	7.1	12.7	9.2	2.4	3.2	13.8	16.5	14.4	3.6	0.0	6.0	0.0	3.2	0.4	14.4
Erpobdella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glossiphonia complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helobdella stagnalis	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pelecypoda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corbicula	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0
Sphaeriidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
Pisidium	8.0	6.4	0.0	0.2	0.0	2.4	0.0	0.0	16.0	19.6	1.0	0.0	272.0	0.0	0.0
Ferrissia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrgulopsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Tryonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.6	0.0	0.0	0.0	0.0	0.0	0.0
Fossaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Radix auricularia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stagnicola	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosuccinea columella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Physella	0.0	7.1	2.0	0.2	4.0	0.0	0.0	0.0	6.4	0.0	51.0	0.0	24.0	0.4	0.0
Gyraulus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	1.6	0.0	0.0
Menetus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planorbella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Valvata humeralis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostracoda	0.4	2.7	1.0	1.8	0.0	34.8	2.1	1.2	2.8	0.0	10.0	1.4	3.2	0.0	0.0
Gammarus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyalella azteca	0.0	0.0	0.0	0.2	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orconectes causeyi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	1.0	0.0	0.0	2.8	0.0
Acari	26.6	1.5	40.2	20.4	59.2	45.0	10.5	164.4	235.2	119.6	456.0	21.4	900.8	86.4	1.4
Order - Odonata															
Aeshnidae-early instar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anax junius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oplonaeschna armata	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Cordulegaster	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
Gomphidae	0.0	0.0	3.0	0.0	3.2	1.2	0.0	6.0	1.2	0.0	11.0	0.0	0.0	0.0	0.0
Libellulidae	0.0	0.3	0.0	0.0	0.0	0.6	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calopterygidae	0.0	0.0	4.0	0.2	1.6	3.0	3.5	2.4	0.0	0.0	2.0	0.0	0.0	0.4	0.0
Coenagrionidae	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Argia	0.0	5.4	8.2	0.2	2.4	28.2	7.7	3.6	2.4	10.8	3.0	4.2	6.4	1.6	0.0
Enallagma/Ischnura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Lestidae	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0
Order - Ephemeroptera															
Baetidae	44.4	2670.7	152.0	116.2	684.0	105.6	218.7	407.2	316.4	428.8	449.0	359.4	219.2	1044.0	59.8
Baetodes	0.0	0.0	0.0	0.0	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0
Caenis	0.0	25.7	0.0	20.6	13.6	61.8	1.4	0.0	32.8	596.4	3.0	285.0	2052.8	0.0	0.0
Drunella coloradensis/flavilinea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella doddsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drunella grandis	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ephemerella	2.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Serratella micheneri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	195.0	0.0	0.0	434.4	0.0
Cinygmula	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epeorus	0.0	3.2	0.0	0.6	0.0	0.0	0.0	0.0	0.0	110.4	0.0	59.8	0.0	0.0	0.0
Heptagenia/Nixe	5.2	41.6	1.2	31.0	1.6	0.0	0.9	0.0	0.0	31.2	0.0	254.4	22.4	14.4	10.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Verde River Basin														Yaqui Ba
	BLC1	EVD1	EVD3	OAK1	PIN1	ROU1	SYH1	SYM1	WBV1	WCC1	WCC3	WEB1	WFO1	VER1	RUC1
Rhithrogena	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenonema	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptophlebiidae	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Choroterpes/Thraulodes	0.0	0.0	2.0	0.0	21.6	132.0	0.3	1.2	2.4	472.8	6.0	320.6	57.6	0.0	0.3
Paraleptophlebia	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traverella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isonychia	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameletus	1.7	11.4	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7
Siphlonurus	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptohyphes	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	343.2	2.0	0.0	3.2	1.6	0.0
Tricorythodes	0.4	8.8	72.0	47.2	284.8	138.6	18.9	444.0	18.8	44.8	102.0	192.0	254.4	588.8	0.0
Order - Plecoptera															
Capniidae	90.1	6.0	27.0	59.2	289.6	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chloroperlidae	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Amphinemura	8.0	22.4	3.6	0.0	2.4	0.0	3.9	0.0	0.0	93.6	2.0	0.0	1.6	0.0	15.8
Zapada cinctipes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zapada columbiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Claassenia sabulosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoperla	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perlodinae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isoperla	0.4	0.0	0.0	0.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0
Taeniopterygidae	20.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0
Order - Hemiptera															
Belastomatidae	0.0	0.0	0.0	0.0	2.4	0.0	0.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abedus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corixidae	0.0	0.9	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Ambrysus	0.0	3.2	0.0	0.0	0.0	1.2	0.0	4.4	5.6	0.0	0.0	14.6	84.8	4.8	0.0
Notonectidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Megaloptera															
Corydalus cornutus	0.0	0.0	1.0	0.0	7.2	6.0	0.0	0.0	9.6	4.8	14.0	5.2	0.0	2.4	0.0
Neohermes filicornis	30.6	0.3	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Order - Trichoptera															
Brachycentrus	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micrasema	4.0	0.0	4.0	0.0	1.6	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phylloicus	0.8	0.3	0.0	0.0	0.0	8.4	1.2	0.0	2.4	2.8	5.0	2.8	92.8	0.0	1.9
Agapetus	2.8	0.0	0.0	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culoptila	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
Glossosoma	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protoptila	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0
Helicopsyche	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	1.2	11.2	1.0	0.0	84.8	0.0	0.0
Atopsyche	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	15.6	0.0	0.0	1.4
Cheumatopsyche	0.0	29.4	8.0	0.0	4.8	6.0	3.5	37.2	12.8	2.4	12.0	15.8	9.6	61.2	0.0
Hydropsyche	0.0	9.6	3.2	1.6	5.6	23.4	0.0	0.0	11.2	0.0	11.0	20.8	1.6	65.2	0.0
Leptonema	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptilidae-early instar	0.4	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroptila	0.0	39.6	2.0	0.0	3.2	1.8	0.7	4.8	0.0	0.0	6.0	0.0	0.0	0.0	0.0
Ithytrichia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	188.0	0.0	0.0	0.0	0.0	0.0
Leucotrichia	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mayatrichia	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	432.8	0.0
Neotrichia	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0
Ochrotrichia	1.6	0.0	0.0	0.0	0.0	15.0	31.5	1.6	3.2	5.6	3.0	0.0	0.0	21.6	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Verde River Basin														Yaqui Ba
	BLC1	EVD1	EVD3	OAK1	PIN1	ROU1	SYH1	SYM1	WBV1	WCC1	WCC3	WEB1	WFO1	VER1	RUC1
Oxyethira	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
Zumatrichia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-early instar	0.0	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lepidostoma-sand case	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
Lepidostoma-turret case	8.4	0.0	0.0	2.4	0.0	6.6	1.5	0.0	0.0	0.0	0.0	0.0	6.4	0.0	1.5
Lepidostoma acarolum-larvae	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2
Lepidostoma ormeum-pupae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae-early instar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nectopsyche	0.0	0.0	3.0	0.0	0.0	0.6	0.7	0.0	0.0	0.0	4.0	0.0	0.0	1.6	0.0
Oecetis	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.7
Triaenodes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnephilidae-early instar	0.0	0.3	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicosmoecinae	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
Eocosmoecus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperophylax	0.0	0.6	0.0	24.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	9.6	0.0	0.0
Limnephilus	0.0	0.0	18.0	2.4	24.0	4.8	0.0	0.0	0.0	5.6	0.0	0.0	3.2	0.0	0.0
Onocosmoecus unicolor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psychoglypha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marilia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chimarra	0.0	0.0	0.0	0.0	9.6	1.8	16.1	0.0	1.6	0.0	0.0	5.2	11.2	0.0	0.0
Wormaldia	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycentropus	0.4	1.2	3.0	4.4	0.0	9.0	4.6	1.2	1.2	5.6	0.0	0.0	0.0	0.0	3.9
Polyplectropus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinodes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Angelita Group	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhyacophila Coloradensis Group	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumaga	0.0	0.3	0.0	1.8	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	470.4	0.0	0.0
Oligophlebodes	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Order - Lepidoptera															
Petrophila	0.0	0.0	3.2	0.0	1.6	1.2	0.0	0.0	17.6	2.4	11.0	2.6	0.0	0.0	0.0
Order - Coleoptera															
Dytiscidae	3.4	19.5	0.0	1.6	0.0	4.2	0.9	6.4	6.0	2.8	0.0	2.6	0.0	0.4	0.9
Deronectes/Oreodytes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dytiscus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryopidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helichus	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	2.0	5.2	6.4	2.4	0.0
Postelichus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Cleptelmis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cylloepus	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dubiraphia	0.0	0.0	10.0	0.0	3.2	0.0	0.0	0.0	1.2	0.0	31.0	1.4	9.6	3.6	0.0
Heterelmis	0.0	19.2	0.0	0.0	1.6	0.6	0.0	0.0	1.2	0.0	0.0	23.4	0.0	5.2	0.0
Heterlimnius larvae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Macrelmis	0.0	0.0	0.0	0.0	2.4	28.8	0.0	0.0	1.6	154.0	0.0	2.6	19.2	0.0	0.0
Microcylloepus	0.4	83.5	166.6	0.0	5.6	23.4	34.3	3.2	57.2	46.8	163.0	18.8	44.8	229.6	0.0
Narpus	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neocylloepus	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	55.2	0.0	49.0	0.0	0.0	0.0	0.0
Neoelmis	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Optioservus	37.6	0.0	2.2	107.8	0.0	0.0	0.0	0.0	0.0	19.2	0.0	33.8	20.8	0.0	0.0
Xenelmis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Zaitzevia	4.0	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	58.0	0.0	0.0	0.0	0.0	1.0
Dineutus-adult	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Verde River Basin														Yaqui Ba
	BLC1	EVD1	EVD3	OAK1	PIN1	ROU1	SYH1	SYM1	WBV1	WCC1	WCC3	WEB1	WFO1	VER1	RUC1
Gyretes-larvae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrinus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliplus-larvae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peltodytes	0.0	0.0	0.0	0.0	0.0	3.6	0.0	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrophilidae other	1.7	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berosus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tropisternus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydroscapha natans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutrochus-larvae	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Noteridae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	2.8	0.0
Psephenus-larvae	2.0	0.0	1.0	0.0	0.0	14.4	11.2	0.0	0.0	19.2	6.0	0.0	0.0	0.4	0.0
Order - Diptera															
Atherix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agathon arizonicus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0
Ceratopoginidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceratopogoninae	25.8	19.5	2.0	0.2	15.2	22.8	15.1	2.4	52.0	16.0	104.0	17.6	54.4	21.6	1.8
Forcipomyiinae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dixa	0.0	0.0	0.0	0.0	0.0	1.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dixella	0.0	0.0	0.0	0.8	0.0	2.4	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Meringodixa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichopodidae	1.7	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	2.4	2.0	0.0	0.0	0.0	0.0
Chelifera	0.0	3.5	4.2	0.2	0.0	0.6	0.7	0.0	3.2	2.4	0.0	22.2	9.6	0.0	0.0
Clinocera	0.4	0.0	0.0	0.0	0.0	0.0	2.1	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hemerodromia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	2.4	0.0
Ephydridae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophora	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maruina	0.0	0.3	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.4	0.0
Pericoma	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ptychoptera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	907.9	3372.0	251.6	11.2	420.0	438.6	75.5	570.4	47.6	258.0	137.0	1106.4	17.6	56.0	52.4
Stratiomyiidae	6.8	5.6	0.0	0.0	4.8	13.2	2.1	3.6	0.0	2.4	0.0	0.0	0.0	0.0	0.0
Syrphidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	0.4	0.0	1.2	2.0	0.0	1.8	0.0	1.2	1.2	0.0	0.0	2.6	4.8	0.0	0.0
Tanyderidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thaumaleidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipulidae	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Antocha	0.4	0.0	0.0	0.8	0.0	0.6	0.0	0.0	0.0	0.0	0.0	2.6	6.4	0.0	0.0
Cryptolabis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dicranota	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	1.6	0.0	2.1
Erioptera (Mesocyphona)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonomyia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperoconopa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexatoma	3.6	0.0	0.0	0.2	0.0	7.2	0.0	3.6	0.0	8.4	0.0	0.0	3.2	0.0	0.0
Holorusia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0
Molophilus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orimarga	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradelphomyia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedicia	0.0	3.2	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Rhabdomastix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tipula	0.0	3.2	0.0	0.0	0.0	4.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Verde River Basin														Yaqui Ba
	BLC1	EVD1	EVD3	OAK1	PIN1	ROU1	SYH1	SYM1	WBV1	WCC1	WCC3	WEB1	WFO1	VER1	RUC1
Family - Chironomidae															
Ablabesmyia	0.0	0.0	2.0	0.2	0.0	1.2	0.0	0.0	0.0	0.0	2.0	0.0	6.4	0.0	0.0
Acamptocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alotanypus	0.0	0.3	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0
Antillocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apedilum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	7.2	0.0
Boreochlus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0
Boreoheptagyia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Boreoheptagyia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brillia	2.1	1.2	5.2	19.2	0.0	12.6	0.7	0.0	0.0	0.0	0.0	45.2	19.2	0.0	1.4
Brundiniella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryophaenocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Camptocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Cardiocladius	0.0	0.0	0.0	0.0	0.0	0.0	2.1	22.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0
Chaetocladius	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0
Cladotanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conchapelopia/Thienemannimyia	12.0	23.8	7.2	7.6	7.2	7.8	50.0	0.0	1.8	22.4	2.0	111.9	59.2	0.4	50.0
Constempellina	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Corynoneura	0.0	4.7	4.0	2.0	1.6	9.6	11.0	0.0	1.8	0.0	0.0	0.0	48.0	0.0	5.4
Cricotopus	5.1	9.6	7.0	0.0	0.0	13.2	0.7	73.2	69.4	4.8	23.0	53.2	36.8	13.2	0.7
Cricotopus (Nostococladius)	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0
Cryptochironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0
Cryptotendipes	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demicryptochironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diamesa	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.7
Dicrotendipes	0.0	0.0	0.0	0.8	0.0	10.2	0.0	0.0	1.8	8.4	1.0	0.0	0.0	0.0	1.4
Djalmabatista	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	28.8	0.0	0.0	0.0	0.0	0.0	0.0
Eukiefferiella COMPLEX	319.4	156.8	42.4	0.2	9.6	39.6	33.6	16.8	25.4	16.8	66.0	299.6	68.8	6.8	1.4
Eukiefferiella/Thienemanniella	0.0	0.0	1.0	0.0	0.0	0.0	2.8	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0
Eukiefferiella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0
Euryhapsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glyptotendipes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goeldichironous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heleniella	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.3
Heterotrissocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
nr. Heterotrissocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrobaenus	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Hyporhygma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenopelopia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krenosmittia	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labrundinia	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Larsia	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lauterborniella	40.4	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
Lopescladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.7
nr. Lopescladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limnophyhes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Mesocricotopus	1.7	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesosmittia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metriocnemus	0.0	1.2	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micropsectra	0.0	0.3	9.2	4.8	0.0	1.2	9.3	0.0	6.6	4.8	1.0	5.2	0.0	0.0	27.5
Microtendipes	0.0	0.0	49.0	8.0	0.0	60.6	0.0	0.0	9.6	8.4	1.0	2.8	147.2	1.2	0.0
Nanocladius	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.8	0.0
Nilotanypus	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	3.2	0.0	0.0
Nilothauma	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0
Odontomesa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Macroinvertebrate Abundances at Reference Sites in Arizona, 1992 (Combined Riffle+Pool, untransformed data)

Taxonomic name	Verde River Basin														Yaqui Ba
	BLC1	EVD1	EVD3	OAK1	PIN1	ROU1	SYH1	SYM1	WBV1	WCC1	WCC3	WEB1	WFO1	VER1	RUC1
Orthocladiinae-unknown genus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	5.2	0.0	0.0	0.0
Orthocladius complex	0.0	14.6	25.0	4.0	54.4	0.0	2.7	6.0	140.2	0.0	32.0	35.8	72.0	0.4	4.8
Orthocladius (Orthocladius)	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.6	0.0	4.0	25.0	0.0	0.0	0.0
Orthocladius (Symposiocladius)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orthocladius (Euorthocladius)	6.3	6.4	0.0	0.6	0.0	6.0	0.0	0.0	0.0	16.8	6.0	142.3	30.4	0.0	0.0
Pagastia	0.0	0.0	3.0	0.8	0.0	1.2	0.0	0.0	6.4	0.0	0.0	5.2	1.6	0.0	0.0
Parachaetocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Parachaetocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parachironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paracladopelma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parakiefferiella	1.7	2.7	1.0	0.0	0.0	1.2	0.0	2.0	19.2	0.0	0.0	0.0	0.0	0.8	0.0
Paralauterborniella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paramerina	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parametriocnemus	2.5	0.6	8.0	0.2	0.0	1.2	10.8	0.0	0.0	2.4	4.0	5.2	3.2	0.0	1.7
Paraphaenocladius	1.7	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.3
Paratanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Paratendipes	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0
Parochlus kiefferi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Pentaneura cf. inconspicua	0.4	0.0	0.0	0.2	0.0	3.0	1.3	4.4	0.0	0.0	2.0	0.0	3.2	0.4	0.6
Pentaneura n. sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	1.0	2.8	1.6	0.0	0.0
Phaenopsectra	0.4	0.0	4.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polypedilum	12.3	3.8	5.0	9.8	1.6	40.2	5.5	22.4	1.8	48.0	36.0	49.0	27.2	0.8	3.4
Potthastia	0.0	0.0	1.0	0.0	0.0	1.2	0.0	0.0	16.2	0.0	21.0	135.9	4.8	0.0	0.0
Procladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prodiamesa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psectrocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudochironomus	0.4	0.3	0.0	0.0	0.0	0.0	0.0	2.4	1.8	0.0	9.0	0.0	0.0	0.4	0.0
Pseudodiamesa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudorthocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseudosmittia	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psilometriocnemus	0.0	3.6	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Rheocricotopus	0.0	0.0	2.0	3.0	0.0	1.2	16.3	3.2	0.0	0.0	6.0	10.4	9.6	0.0	17.0
Rheopelopia	0.0	5.9	0.0	0.2	14.4	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Rheotanytarsus	0.4	3.2	36.2	0.0	3.2	1.2	14.7	20.0	1.8	0.0	45.0	5.2	0.0	10.4	0.0
Robackia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nr. Robackia	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saetheria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smittia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stempellinella	11.0	3.2	12.0	0.0	0.0	11.4	21.3	0.0	25.6	0.0	15.0	5.6	0.0	0.0	22.7
Stempellina	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenochironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stictochironomus	0.0	0.3	0.0	8.8	0.0	5.4	0.0	1.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0
Stilocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sublettia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symbiocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Synorthocladius	0.0	0.0	3.0	0.2	2.4	6.0	0.7	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.7
Tanytarsus	4.8	4.1	14.8	1.6	0.0	5.4	1.3	2.4	4.8	0.0	38.0	1.4	14.4	0.0	2.0
Telopelopia okoboji	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemanniella	1.2	3.2	0.0	0.0	4.0	9.0	2.1	0.0	1.8	2.4	0.0	0.0	0.0	0.0	0.0
Thienemannimyia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thienemannimyia barberi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tvetenia	11.9	77.4	2.2	0.0	0.0	2.4	4.9	0.0	0.0	0.0	2.0	57.0	14.4	0.0	0.0
Xestochironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Zavrelimyia	0.0	3.2	0.0	0.0	0.0	0.0	7.5	1.2	0.0	2.8	0.0	0.0	43.2	0.0	7.5

APPENDIX F.

Chemistry results for surface water samples collected at Arizona reference sites in 1992.
(F1-F9)

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	NUTRIENTS				FIELD PARAMETERS				
PARAMETER	NO2/NO3	Ammonia	Total Kjedahl N	Total Phosphorus	Water Temperature	Dissolved Oxygen	Field Conductivity	Field pH	Field Turbidity
UNITS	mg/L	mg/L	mg/L	mg/L	C	mg/L	umhos/cm		NTU
DETECTION LEVEL	0.1	0.1	0.1	0.1					
LITTLE COLORADO BASIN									
Barbershop Canyon (Lower)	ND	ND	ND	ND	12.9	7.2	182.0	7.6	1.2
Barbershop Canyon (Upper)	ND	ND	ND	ND	14.8	7.9	151.3	7.7	1.0
Chevelon Canyon (Chevelon Crossing)	ND	ND	0.5	ND	21.1	7.4	142.6	8.3	7.8
Chevelon Canyon (Long Tom)	ND	ND	ND	ND	16.7	7.0	132.0	6.9	0.9
Chevelon Canyon (Telephone Ridge)	ND	ND	ND	ND	16.7	7.7	179.7	8.2	1.3
East Clear Cr. (Kinder Crossing)	ND	ND	ND	0.1	19.3	7.5	250.8	8.4	1.4
East Clear Cr. (Macks Crossing)	ND	ND	0.2	ND	19.5	7.7	278.9	8.5	0.6
East Fk Little Colorado R.	ND	ND	0.3	0.1	17.6	6.8	35.1	7.5	4.8
Lily Cr.	ND	ND	0.2	0.2	10.8	8.1	191.8	8.1	3.2
Little Colorado R. (Mouth)	0.3	ND	1.1	0.9	21.0	7.7	3825.0	7.7	+++
Little Colorado R. (abv S. Fk.)	ND	ND	0.4	0.1	16.9	7.4	81.4	7.0	7.6
Little Colorado R. (blw Nutrioso)	ND	ND	0.5	0.2	20.5	7.7	455.6	8.7	16.2
Little Colorado R. (blw S. Fk.)	ND	ND	0.4	0.2	19.2	5.9	92.7	8.1	8.9
Mamie Cr.	ND	ND	0.2	0.1	7.8	8.4	119.9	7.6	8.3
Mineral Cr.	ND	ND	0.2	0.1	11.7	8.2	82.4	7.8	5.6
Paddy Cr.	ND	ND	0.2	0.1	8.8	8.4	116.0	7.9	1.5
Rudd Cr.	ND	ND	0.3	0.1	12.1	7.8	198.2	7.9	4.9
S. Fk. Little Colorado R.	ND	ND	0.3	0.1	13.7	7.3	189.4	7.8	0.6
West Fk. Little Colorado R. (Lower)	ND	ND	0.3	0.1	15.4	8.3	39.0	7.0	1.3
West Fk. Little Colorado R. (Upper)	ND	ND	0.2	0.1	10.9	7.1	57.5	7.4	1.6
UPPER GILA BASIN									
Blue R. (Lower)	ND	ND	0.1	0.1	17.4	8.4	432.9	8.1	0.8
Blue R. (Upper)	ND	ND	0.2	0.2	18.8	7.1	284.0	8.1	3.1
Campbell Blue R.	ND	ND	LT	0.2	19.8	6.4	174.3	7.9	3.9
Coleman Cr.	ND	ND	0.2	ND	8.7	8.6	123.3	7.7	4.8
Eagle Cr. (Honeymoon)	ND	ND	0.2	0.1	20.8	7.0	260.5	8.3	0.7
Eagle Cr. (Sheep Wash)	ND	ND	0.2	0.1	28.1	7.1	267.9	7.1	3.2
East Turkey Cr.	ND	ND	0.2	ND	7.9	10.0	93.2	8.2	8.6
Frye Cr.	ND	ND	0.2	ND	9.4	8.1	57.8	7.5	1.2
Grant Cr. (Blue)	ND	ND	0.1	0.2	13.5	8.6	160.0	8.0	3.0
Grant Cr. (Pinaleno)	ND	ND	0.1	ND	5.2	9.4	30.0	7.6	5.2
Lanphier Canyon	ND	ND	0.3	ND	14.6	8.2	189.0	6.8	1.6
Marijilda Cr.	ND	ND	ND	ND	5.7	9.5	48.8	7.5	1.4
San Francisco R. (Blue)	ND	ND	0.1	0.1	26.8	7.6	430.1	8.5	2.9
South Fk Cave Cr.	ND	ND	0.2	ND	9.4	9.1	68.2	7.7	8.2
UPPER SALT BASIN									
Conklin Cr.	ND	ND	LT	0.1	10.5	8.5	84.2	7.9	2.9
East Fork Black R.	ND	ND	0.2	ND	14.7	8.2	101.3	8.8	3.5
Horton Cr.	ND	ND	LT	0.1	7.0	9.4	89.7	8.3	1.7
N. Fk. Bear Wallow Cr.	ND	ND	LT	0.2	7.9	7.8	74.5	7.6	1.7
Reservation Cr.	ND	ND	LT	0.1	10.6	9.1	55.2	7.6	3.1
West Fork Black R.	ND	ND	LT	0.1	7.7	9.4	102.0	7.5	4.5
MIDDLE SALT BASIN									
Campaign Cr.	ND	ND	0.1	ND	20.2	8.4	438.5	8.4	0.4
Canyon Cr.	ND	ND	ND	ND	11.3	9.4	146.0	8.4	4.2
Cherry Cr. (Lower)	ND	ND	ND	ND	18.9	8.5	401.2	8.4	1.1
Cherry Cr. (Upper)	ND	ND	0.3	0.1	25.3	9.0	318.0	8.5	1.6
Deer Cr.	ND	ND	0.2	ND	13.2	9.9	195.0	8.1	0.6
Greenback Cr.	ND	ND	0.2	ND	25.6	8.2	495.0	8.4	1.3
Haigler Cr.	ND	ND	ND	ND	16.0	8.6	318.0	8.3	0.5
Reynolds Cr.	ND	ND	0.4	ND	16.7	8.1	342.2	8.3	0.8
Salome Cr.	ND	ND	0.2	ND	19.9	8.4	188.7	8.5	2.2
Spring Cr.	ND	ND	0.1	ND	19.5	M	800.0	8.1	1.8
Tonto Cr. (Gisela)	ND	ND	0.2	ND	13.8	9.3	189.2	7.5	5.9
Workman Cr.	ND	ND	0.2	ND	13.3	8.6	274.3	8.3	3.8

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	NUTRIENTS				FIELD PARAMETERS				
PARAMETER	NO2/NO3	Ammonia	Total Kjedahl N	Total Phosphorus	Water Temperature	Dissolved Oxygen	Field Conductivity	Field pH	Field Turbidity
UNITS	mg/L	mg/L	mg/L	mg/L	C	mg/L	umhos/cm		NTU
DETECTION LEVEL	0.1	0.1	0.1	0.1					
SAN PEDRO/WILLCOX BASINS									
Aravaipa Canyon (East)	0.5	ND	0.1	ND	16.2	8.2	396.0	8.3	25.0
Aravaipa Canyon (West)	0.4	ND	0.1	0.2	20.7	8.5	370.4	8.8	9.3
Bass Canyon	ND	ND	0.2	0.2	15.6	8.0	72.0	7.1	5.9
Goudy Cr.	ND	ND	0.2	ND	9.9	8.0	60.0	7.8	1.5
Hot Springs Canyon	ND	ND	0.2	ND	16.0	9.1	175.0	8.4	1.5
Ramsey Canyon	ND	ND	0.2	ND	10.3	9.8	366.0	8.2	0.4
Redfield Canyon	ND	ND	0.3	ND	16.2	8.8	195.0	7.6	3.6
San Pedro R.	ND	ND	0.1	ND	16.4	10.0	476.0	8.8	14.2
Ward Canyon	ND	ND	0.1	ND	9.1	9.0	72.0	7.2	3.3
SANTA CRUZ BASIN									
Canada del Oro Cr.	ND	ND	0.2	ND	18.0	8.0	111.0	8.0	0.6
Cave Cr.	ND	ND	ND	ND	7.9	9.4	74.0	7.0	2.4
Cienega Cr.	ND	ND	0.2	ND	18.5	11.8	503.0	8.7	3.7
Gardner Cr.	ND	ND	ND	ND	8.6	9.5	39.0	7.2	4.3
Madera Cr.	ND	ND	ND	ND	10.4	9.3	349.1	7.8	1.1
Sabino Cr.	ND	ND	0.2	0.1	16.6	8.8	60.4	7.3	4.3
Santa Cruz R.	ND	ND	ND	ND	14.1	9.5	316.0	8.1	1.8
RIO DE MEXICO BASINS									
Rucker Cr.	ND	ND	ND	ND	8.2	9.2	40.0	7.2	4.1
Sycamore Cr. (Sonora)	ND	ND	0.2	ND	17.6	6.8	143.9	6.9	3.6
VERDE BASIN									
Black Canyon	ND	ND	0.1	ND	14.9	8.1	380.7	8.0	0.5
East Verde R. (Brushy Canyon)	ND	ND	0.2	ND	20.6	8.7	375.0	8.2	4.2
East Verde R. (Ellison)	ND	ND	0.6	ND	19.7	8.3	420.0	8.5	2.2
Oak Cr. (Baldwin Crossing)	ND	ND	0.3	ND	18.4	9.2	250.0	8.2	3.8
Oak Cr. (Chavez Crossing)	ND	ND	0.3	ND	15.3	8.5	250.0	8.2	5.2
Oak Cr. (Grasshopper Pt.)	0.1	ND	0.1	ND	18.2	7.6	248.0	8.3	1.0
Oak Cr. (Pine Flat)	ND	ND	0.1	0.1	16.9	9.0	200.0	8.7	0.5
Oak Cr. (Red Rock)	ND	ND	0.2	ND	21.5	8.2	291.0	6.8	6.8
Pine Cr.	ND	ND	0.1	ND	17.3	7.8	335.0	8.3	0.4
Roundtree Cr.	ND	ND	0.1	0.1	19.6	7.9	491.0	8.6	0.3
Sycamore Cr. (Horseshoe)	ND	ND	0.1	ND	16.6	7.4	285.0	7.9	0.4
Sycamore Cr. (Mazatzal)	0.1	ND	0.2	ND	20.4	7.3	360.0	8.1	0.5
Verde R. (Perkinsville)	0.2	ND	0.3	ND	19.2	8.6	480.0	8.4	10.0
Webber Cr.	ND	ND	0.1	0.1	10.7	9.3	190.0	8.0	3.4
West Clear Cr. (Lower)	ND	ND	0.3	ND	15.9	8.4	220.0	8.2	0.6
West Clear Cr. (Upper)	0.2	ND	0.1	0.1	12.0	9.2	155.0	8.3	1.1
West Fork Oak Cr.	ND	ND	0.2	ND	11.7	9.0	262.0	8.1	1.5
Wet Beaver Cr.	0.2	ND	0.3	ND	17.5	7.6	200.0	8.2	0.6
MIDDLE GILA BASIN									
Agua Fria R.	ND	ND	0.2	0.1	20.1	9.8	743.7	8.3	1.3
Antelope Cr.	ND	ND	0.2	ND	17.9	9.1	557.8	8.5	1.2
Ash Cr.	ND	ND	0.2	ND	16.4	8.3	270.2	7.8	4.5
Hassayampa R. (Upper)	ND	ND	0.2	ND	15.2	8.8	450.1	8.3	2.3
Lion Canyon	0.2	ND	0.1	ND	20.1	5.6	610.5	7.4	1.3
Little Ash Cr.	0.2	ND	0.1	ND	16.0	5.8	475.5	7.5	1.6
Poland Cr.	ND	ND	0.2	ND	19.3	8.7	249.8	8.0	0.5
Sycamore Cr. (Dugas)	ND	ND	ND	ND	15.9	9.1	456.2	8.2	1.1
BILL WILLIAMS BASIN									
Burro Cr.	ND	ND	0.2	ND	24.7	8.7	427.2	8.3	1.6
Conger Cr.	0.4	ND	ND	ND	23.1	6.6	332.8	8.0	0.2
Francis Cr.	ND	ND	0.1	ND	22.0	9.2	975.2	8.0	2.4
Peeples Canyon	0.5	ND	ND	ND	22.5	8.0	393.8	7.6	0.2
Santa Maria R.	ND	ND	0.2	ND	23.6	8.7	638.6	8.7	1.5
Trout Cr.	ND	ND	0.9	ND	22.4	8.1	476.2	8.8	6.5

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	NUTRIENTS				FIELD PARAMETERS				
PARAMETER	NO2/NO3	Ammonia	Total Kjedahl N	Total Phosphorus	Water Temperature	Dissolved Oxygen	Field Conductivity	Field pH	Field Turbidity
UNITS	mg/L	mg/L	mg/L	mg/L	C	mg/L	umhos/cm		NTU
DETECTION LEVEL	0.1	0.1	0.1	0.1					
NORTHERN COLORADO MAINSTEM									
Bright Angel Cr.	ND	ND	0.2	ND	16.2	8.8	252.0	8.6	3.3
Havasu Cr.	0.1	ND	0.2	0.5	23.0	8.2	633.0	8.2	4.4
Hermit Cr.	0.3	ND	ND	ND	24.0	7.5	356.0	8.8	1.4
Kanab Cr.	ND	ND	0.2	ND	23.2	NA	NA	7.3	2.3
Matkatamiba Cr.	0.5	ND	ND	ND	19.0	8.5	1333.0	8.3	0.8
Nankoweap Cr.	ND	ND	ND	ND	25.2	7.1	499.0	8.6	21.6
Paria R.	0.8	ND	0.9	0.7	24.5	6.7	1945.0	8.1	+++
Royal Arch Cr.	0.7	ND	ND	ND	17.0	9.0	660.0	8.5	1.6
Spring Canyon	0.6	ND	ND	ND	26.5	6.1	586.0	8.3	0.6
Tapeats Cr.	0.1	ND	0.3	0.1	15.3	9.5	235.0	8.6	2.4

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	GENERAL PARAMETERS				MAJOR ANIONS						MAJOR CATIONS			
PARAMETER	Hardness	Tot. Diss. Solids	Tot. Susp. Solids	Total Alkalinity	HCO3	CO3	Cl	Fl	NO2/NO3	SO4	Ca	Mg	Na	K
UNITS	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
DETECTION LEVEL	10.0		4.0			2.0	1.0	0.2	0.1	10.0	1.0	1.0	5.0	0.5
LITTLE COLORADO BASIN														
Barbershop Canyon (Lower)	96.0	107.0	5.0	93.7	114.0	ND	1.2	ND	ND	ND	18.8	9.8	ND	0.4
Barbershop Canyon (Upper)	76.0	90.0	7.0	65.2	79.5	ND	1.0	ND	ND	ND	14.7	7.4	ND	0.4
Chevelon Canyon (Chevelon Crossing)	69.0	83.0	14.0	62.8	76.6	ND	1.3	ND	ND	ND	14.5	5.4	ND	0.7
Chevelon Canyon (Long Tom)	67.0	84.0	7.0	64.8	79.1	ND	1.8	ND	ND	ND	15.7	5.0	ND	0.7
Chevelon Canyon (Telephone Ridge)	107.0	119.0	8.0	105.0	128.0	ND	2.1	ND	ND	ND	23.3	9.4	ND	0.8
East Clear Cr. (Kinder Crossing)	135.0	142.0	6.0	129.0	157.0	ND	2.0	ND	ND	ND	26.7	14.0	ND	0.6
East Clear Cr. (Macks Crossing)	147.0	153.0	6.0	142.0	166.0	3.4	2.8	ND	ND	ND	27.1	15.8	ND	0.6
East Fk Little Colorado R.	16.0	50.0	6.0	20.0	24.4	ND	ND	ND	ND	ND	5.3	1.1	ND	1.9
Lily Cr.	90.0	151.0	18.0	90.0	110.0	ND	1.2	ND	ND	ND	23.8	7.6	6.5	1.0
Little Colorado R. (Mouth)	NA	2300.0	2200.0	NA	NA	NA	1150.0	0.2	0.3	160.0	78.8	61.0	693.0	6.4
Little Colorado R. (abv S. Fk.)	30.0	82.0	18.0	36.9	45.0	ND	1.4	ND	ND	ND	8.4	2.0	ND	2.1
Little Colorado R. (blw Nutrioso)	165.0	210.0	15.0	209.0	233.0	11.0	6.9	0.3	ND	10.1	40.0	16.2	25.8	3.9
Little Colorado R. (blw S. Fk.)	33.0	88.0	18.0	39.4	48.1	ND	1.3	ND	ND	ND	9.6	2.9	ND	2.1
Mamie Cr.	56.0	112.0	19.0	49.3	60.1	ND	1.9	ND	ND	10.3	14.0	4.6	ND	0.8
Mineral Cr.	43.0	78.0	6.0	45.0	54.9	ND	ND	ND	ND	ND	9.0	4.9	ND	0.7
Paddy Cr.	52.0	94.0	ND	53.0	64.7	ND	ND	ND	ND	ND	12.3	4.4	ND	0.9
Rudd Cr.	78.0	96.0	10.0	88.9	108.0	ND	2.2	ND	ND	10.6	19.6	7.0	10.3	1.3
S. Fk. Little Colorado R.	77.0	130.0	5.0	97.0	118.0	ND	1.2	ND	ND	ND	18.6	7.6	8.7	2.2
West Fk. Little Colorado R. (Lower)	17.0	39.0	ND	22.5	27.5	ND	ND	ND	ND	ND	LT	1.4	ND	1.9
West Fk. Little Colorado R. (Upper)	ND	10.0	5.0	13.5	16.5	ND	ND	ND	ND	ND	LT	ND	ND	1.5
UPPER GILA BASIN														
Blue R. (Lower)	165.0	291.0	ND	158.0	185.0	3.7	28.5	0.3	ND	23.2	43.8	11.8	28.7	2.0
Blue R. (Upper)	123.0	184.0	7.0	127.0	148.0	3.5	2.5	0.2	ND	ND	35.2	9.1	11.5	0.9
Campbell Blue R.	70.0	116.0	9.0	80.7	98.5	ND	2.0	ND	ND	ND	18.0	7.3	6.9	0.9
Coleman Cr.	54.0	97.0	6.0	50.7	61.9	ND	2.0	ND	ND	ND	11.1	5.9	ND	0.7
Eagle Cr. (Honeymoon)	115.0	190.0	ND	127.0	155.0	ND	3.2	ND	ND	ND	24.2	11.8	7.4	2.9
Eagle Cr. (Sheep Wash)	117.0	195.0	5.0	130.0	129.0	14.6	3.1	0.2	ND	ND	26.8	11.4	8.3	3.2
East Turkey Cr.	39.0	82.0	7.0	28.3	34.5	ND	1.6	ND	ND	14.7	10.9	2.1	ND	1.0
Frye Cr.	25.0	47.0	ND	21.0	25.6	ND	1.0	ND	ND	ND	7.1	1.3	ND	1.1
Grant Cr. (Blue)	70.0	114.0	ND	71.8	87.6	ND	2.0	ND	ND	ND	17.2	6.9	ND	0.9
Grant Cr. (Pinaleno)	20.0	40.0	9.0	14.1	17.2	ND	1.2	ND	ND	ND	5.3	1.2	ND	0.6
Lanphier Canyon	91.0	144.0	5.0	91.6	112.0	ND	2.5	ND	ND	ND	22.2	8.9	ND	1.4
Marijilda Cr.	24.0	47.0	5.0	19.2	23.4	ND	1.2	ND	ND	ND	7.2	1.2	ND	0.8
San Francisco R. (Blue)	139.0	287.0	ND	141.0	156.0	7.8	36.4	0.6	ND	20.3	38.5	9.5	38.5	4.3
South Fk Cave Cr.	27.0	80.0	ND	15.7	19.2	ND	1.7	0.4	ND	14.4	8.3	1.0	ND	1.2
UPPER SALT BASIN														
Conklin Cr.	37.0	60.0	28.0	35.4	43.2	ND	3.4	ND	ND	ND	7.7	4.3	ND	0.7
East Fork Black R.	43.0	71.0	20.0	48.7	52.3	3.5	4.0	ND	ND	ND	10.3	4.5	ND	1.0
Horton Cr.	36.0	73.0	ND	33.1	40.4	ND	3.8	ND	ND	ND	7.3	4.2	ND	0.7
N. Fk. Bear Wallow Cr.	28.0	62.0	12.0	28.0	34.2	ND	3.0	ND	ND	ND	6.6	3.3	ND	0.7
Reservation Cr.	19.0	60.0	ND	23.1	28.2	ND	4.0	ND	ND	ND	5.0	1.7	ND	1.1
West Fork Black R.	22.0	53.0	17.0	22.4	27.3	ND	2.9	ND	ND	ND	5.6	1.9	ND	1.0

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	GENERAL PARAMETERS				MAJOR ANIONS						MAJOR CATIONS			
PARAMETER	Hardness	Tot. Diss. Solids	Tot. Susp. Solids	Total Alkalinity	HCO3	CO3	Cl	Fl	NO2/NO3	SO4	Ca	Mg	Na	K
UNITS	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
DETECTION LEVEL	10.0		4.0			2.0	1.0	0.2	0.1	10.0	1.0	1.0	5.0	0.5
MIDDLE SALT BASIN														
Campaign Cr.	196.0	289.0	ND	195.0	232.0	2.9	7.2	0.6	ND	33.2	42.6	20.6	18.6	1.8
Canyon Cr.	96.0	118.0	4.0	91.7	112.0	ND	3.5	ND	ND	ND	27.9	6.6	ND	ND
Cherry Cr. (Lower)	179.0	213.0	ND	175.0	197.0	8.0	12.8	0.2	ND	11.4	41.1	20.0	13.8	2.0
Cherry Cr. (Upper)	164.0	202.0	ND	163.0	176.0	11.4	5.5	0.2	ND	ND	34.2	17.1	8.2	1.5
Deer Cr.	87.0	130.0	ND	86.0	105.0	ND	2.6	ND	ND	10.7	21.7	7.3	5.8	0.9
Greenback Cr.	242.0	295.0	ND	244.0	265.0	16.0	9.6	0.3	ND	12.7	45.0	30.9	13.9	2.8
Halgler Cr.	196.0	220.0	ND	199.0	228.0	7.4	3.9	ND	ND	ND	46.0	20.1	ND	0.5
Reynolds Cr.	193.0	238.0	ND	188.0	229.0	ND	3.4	ND	ND	13.4	41.0	23.3	5.9	1.4
Salome Cr.	86.0	124.0	ND	80.0	91.7	2.9	3.6	ND	ND	ND	22.0	8.5	ND	1.5
Spring Cr.	181.0	180.0	ND	181.0	216.0	2.5	5.2	ND	ND	ND	42.4	17.3	4.9	1.5
Tonto Cr. (Gisela)	95.0	121.0	5.0	87.1	106.0	ND	3.1	ND	ND	ND	25.8	6.7	ND	0.9
Workman Cr.	139.0	186.0	ND	135.0	165.0	ND	2.6	ND	ND	ND	29.3	16.5	6.7	1.1
SAN PEDRO/WILLCOX BASINS														
Aravalpa Canyon (East)	150.0	244.0	19.0	160.0	195.0	ND	6.6	0.8	0.5	29.5	46.4	7.9	21.6	2.4
Aravalpa Canyon (West)	157.0	265.0	8.0	156.0	179.0	4.7	6.6	0.7	0.4	28.9	45.2	8.2	20.8	3.1
Bass Canyon	42.0	103.0	ND	36.6	44.7	ND	2.4	0.2	ND	19.5	10.4	3.9	9.8	2.4
Goudy Cr.	32.0	61.0	6.0	26.2	32.0	ND	1.9	0.3	ND	11.0	8.9	2.1	ND	0.9
Hot Springs Canyon	63.0	141.0	ND	88.6	108.0	ND	3.4	0.7	ND	18.5	17.4	4.8	21.1	2.6
Ramsey Canyon	191.0	217.0	ND	177.0	216.0	ND	1.8	ND	ND	27.3	56.6	9.1	ND	0.5
Redfield Canyon	64.0	136.0	ND	51.0	62.2	ND	3.1	0.2	ND	33.7	15.8	6.1	11.1	1.7
San Pedro R.	171.0	300.0	8.0	194.0	226.0	4.3	8.4	0.5	ND	44.5	46.6	12.2	38.7	2.6
Ward Canyon	27.0	81.0	ND	16.3	19.9	ND	1.4	ND	ND	14.4	7.7	1.2	ND	0.7
SANTA CRUZ BASIN														
Canada del Oro Cr.	50.0	108.0	ND	48.8	59.5	ND	4.2	0.3	ND	ND	14.1	3.2	8.4	0.8
Cave Cr.	28.0	65.0	ND	21.6	26.4	ND	1.5	ND	ND	11.7	8.6	ND	ND	0.7
Cienega Cr.	145.0	252.0	ND	193.0	224.0	5.8	7.1	0.4	ND	52.8	40.3	8.6	46.8	1.6
Gardner Cr.	13.0	40.0	ND	8.5	10.4	ND	1.6	ND	ND	ND	ND	ND	6.6	4.6
Madera Cr.	160.0	246.0	4.0	116.0	142.0	ND	4.1	0.3	ND	59.4	53.9	6.6	10.5	0.9
Sabino Cr.	24.0	80.0	4.0	19.5	23.8	ND	2.3	ND	ND	ND	6.7	1.6	ND	0.8
Santa Cruz R.	146.0	210.0	ND	155.0	189.0	ND	4.8	0.3	ND	17.0	42.7	6.3	12.9	1.9
RIO DE MEXICO BASINS														
Rucker Cr.	14.0	53.0	ND	6.6	8.1	ND	1.7	0.2	ND	11.0	3.9	ND	ND	1.0
Sycamore Cr. (Sonora)	47.0	137.0	ND	48.8	59.5	ND	5.3	ND	ND	11.3	14.6	2.6	6.6	3.4

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	GENERAL PARAMETERS				MAJOR ANIONS						MAJOR CATIONS			
PARAMETER	Hardness	Tot. Diss. Solids	Tot. Susp. Solids	Total Alkalinity	HCO3	CO3	Cl	Fl	NO2/NO3	SO4	Ca	Mg	Na	K
UNITS	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
DETECTION LEVEL	10.0		4.0			2.0	1.0	0.2	0.1	10.0	1.0	1.0	5.0	0.5
VERDE BASIN														
Black Canyon	202.0	247.0	ND	200.0	244.0	ND	4.3	ND	ND	16.3	47.8	22.0	9.5	1.2
East Verde R. (Brushy Canyon)	235.0	241.0	ND	223.0	261.0	4.7	3.5	ND	ND	ND	49.7	24.4	5.5	0.9
East Verde R. (Ellison)	283.0	271.0	4.0	267.0	317.0	3.6	2.3	ND	ND	ND	66.1	26.0	ND	0.8
Oak Cr. (Baldwin Crossing)	151.0	182.0	39.0	157.0	183.0	4.0	4.2	ND	ND	ND	35.7	17.6	ND	1.0
Oak Cr. (Chavez Crossing)	148.0	164.0	8.0	154.0	181.0	3.4	4.4	ND	ND	ND	35.8	18.0	ND	1.0
Oak Cr. (Grasshopper Pt.)	139.0	163.0	ND	148.0	172.0	4.2	2.8	ND	0.1	ND	34.1	17.1	ND	0.9
Oak Cr. (Pine Flat)	120.0	141.0	ND	126.0	145.0	4.3	2.2	ND	ND	ND	29.3	14.1	ND	0.7
Oak Cr. (Red Rock)	154.0	183.0	6.0	159.0	185.0	4.4	3.7	ND	ND	ND	37.5	18.4	5.1	1.1
Pine Cr.	205.0	243.0	ND	209.0	255.0	ND	5.0	ND	ND	ND	51.0	18.6	7.6	0.9
Roundtree Cr.	226.0	331.0	ND	248.0	303.0	ND	8.5	0.3	ND	10.1	53.0	23.1	19.2	1.8
Sycamore Cr. (Horseshoe)	143.0	237.0	4.0	165.0	201.0	ND	4.7	2.1	ND	ND	44.4	8.6	18.2	1.3
Sycamore Cr. (Mazatzal)	169.0	250.0	ND	181.0	215.0	2.4	7.8	0.9	0.1	19.3	38.9	16.1	22.6	1.3
Verde R. (Perkinsville)	184.0	319.0	7.0	251.0	294.0	10.3	21.1	0.5	0.2	15.3	35.8	23.6	57.0	4.6
Webber Cr.	138.0	162.0	ND	133.0	162.0	ND	2.5	ND	ND	ND	35.5	10.5	ND	0.5
West Clear Cr. (Lower)	177.0	196.0	ND	180.0	133.0	35.5	3.1	ND	ND	ND	36.6	19.6	6.7	1.3
West Clear Cr. (Upper)	114.0	132.0	ND	109.0	133.0	ND	2.6	ND	0.2	ND	23.3	11.8	ND	0.5
West Fork Oak Cr.	187.0	202.0	ND	183.0	212.0	5.4	2.6	ND	ND	ND	46.0	21.0	ND	0.7
Wet Beaver Cr.	115.0	143.0	ND	125.0	153.0	ND	2.4	ND	0.2	ND	23.1	13.6	7.6	1.6
MIDDLE GILA BASIN														
Agua Fria R.	313.0	499.0	4.0	241.0	281.0	6.5	39.3	0.3	ND	93.9	70.5	32.1	44.2	2.5
Antelope Cr.	282.0	390.0	ND	296.0	342.0	9.5	13.2	0.5	ND	15.5	44.4	39.6	20.6	3.1
Ash Cr.	170.0	213.0	ND	176.0	215.0	ND	4.2	ND	ND	ND	50.4	11.8	6.9	1.0
Hassayampa R. (Upper)	212.0	307.0	ND	145.0	177.0	ND	9.1	0.4	ND	81.7	49.0	18.6	13.3	1.7
Lion Canyon	241.0	392.0	ND	242.0	295.0	ND	27.6	1.1	0.2	43.9	54.5	24.2	41.6	2.9
Little Ash Cr.	230.0	328.0	ND	230.0	281.0	ND	10.1	0.2	0.2	ND	51.6	24.2	16.1	2.6
Poland Cr.	94.0	184.0	ND	71.4	87.1	ND	7.2	ND	ND	37.7	24.4	7.2	12.4	1.9
Sycamore Cr. (Dugas)	229.0	332.0	6.0	225.0	265.0	4.8	7.4	0.2	ND	ND	51.2	24.7	11.5	1.2
BILL WILLIAMS BASIN														
Burro Cr.	165.0	270.0	ND	210.0	237.0	9.2	14.0	0.3	ND	ND	33.3	19.4	35.1	6.3
Conger Cr.	144.0	241.0	ND	157.0	192.0	ND	10.5	0.3	0.4	ND	33.4	14.3	16.3	3.6
Francis Cr.	134.0	257.0	ND	156.0	180.0	4.9	12.4	0.3	ND	ND	35.6	12.9	22.3	7.0
Peeples Canyon	146.0	290.0	4.0	157.0	192.0	ND	22.9	0.4	0.5	12.2	48.6	7.6	19.8	8.7
Santa Maria R.	147.0	375.0	6.0	166.0	177.0	12.4	51.3	1.4	ND	70.9	30.6	16.9	82.6	5.5
Trout Cr.	146.0	306.0	10.0	216.0	228.0	17.4	19.0	0.6	ND	11.1	31.9	15.2	46.0	7.9
NORTHERN COLORADO MAINSTEM														
Bright Angel Cr.	NA	150.0	ND	NA	NA	NA	3.8	0.1	ND	7.0	37.8	17.7	3.1	1.1
Havasu Cr.	NA	380.0	ND	NA	NA	NA	47.0	0.2	0.1	35.0	44.7	42.8	34.7	4.5
Hermit Cr.	NA	210.0	ND	NA	NA	NA	12.0	0.2	0.3	18.0	35.5	31.0	6.6	2.2
Kanab Cr.	NA	900.0	ND	NA	NA	NA	21.0	0.3	ND	490.0	146.0	63.4	32.3	6.0
Matkatamiba Cr.	NA	1100.0	ND	NA	NA	NA	21.0	0.6	0.5	610.0	181.0	76.8	17.3	6.1
Nankoweap Cr.	NA	290.0	12.0	NA	NA	NA	6.6	0.2	ND	66.0	31.2	45.7	14.8	4.2
Paria R.	NA	1400.0	1400.0	NA	NA	NA	19.0	0.4	0.8	850.0	258.0	38.1	103.0	9.8
Royal Arch Cr.	NA	500.0	ND	NA	NA	NA	26.0	0.4	0.7	210.0	80.5	45.5	17.0	3.6
Spring Canyon	NA	420.0	ND	NA	NA	NA	18.0	0.3	0.6	130.0	80.2	35.8	12.6	1.7
Tapeats Cr.	NA	150.0	ND	NA	NA	NA	1.4	0.1	0.1	5.0	42.0	16.9	1.6	ND

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	AS	BA	B	CD	CR	CU	FE	PB	MN	HG	SE	AG	ZN	TL
METALS	AS	BA	B	CD	CR	CU	FE	PB	MN	HG	SE	AG	ZN	TL
UNITS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
DETECTION LEVEL	10.0	100.0	100.0	1.0	10.0	10.0	100.0	10.0	50.0	0.5	5.0	1.0	50.0	5.0
LITTLE COLORADO BASIN														
Barbershop Canyon (Lower)	ND	ND	ND	ND	ND	ND	140.0	ND	50.0	ND	ND	ND	ND	ND
Barbershop Canyon (Upper)	ND	ND	ND	ND	ND	ND	130.0	ND	ND	ND	ND	ND	50.0	ND
Chevelon Canyon (Chevelon Crossing)	ND	ND	ND	ND	ND	ND	240.0	ND	ND	ND	ND	ND	ND	ND
Chevelon Canyon (Long Tom)	ND	ND	ND	ND	ND	ND	130.0	ND	ND	ND	ND	ND	50.0	ND
Chevelon Canyon (Telephone Ridge)	ND	ND	ND	ND	ND	ND	170.0	ND	ND	ND	ND	ND	ND	ND
East Clear Cr. (Kinder Crossing)	ND	ND	ND	ND	ND	ND	190.0	ND	50.0	ND	ND	ND	ND	ND
East Clear Cr. (Macks Crossing)	ND	ND	ND	ND	ND	ND	140.0	ND	ND	ND	ND	ND	ND	ND
East Fk Little Colorado R.	ND	ND	ND	ND	ND	20.0	760.0	ND	ND	ND	ND	ND	60.0	ND
Lily Cr.	ND	ND	ND	ND	ND	ND	210.0	ND	ND	ND	ND	ND	ND	ND
Little Colorado R. (Mouth)	11.0	NA	NA	0.8	50.0	27.0	NA	20.0	NA	ND	ND	ND	496.0	ND
Little Colorado R. (abv S. Fk.)	ND	ND	ND	ND	ND	16.0	870.0	ND	70.0	ND	ND	ND	ND	ND
Little Colorado R. (blw Nutrioso)	ND	ND	ND	ND	ND	29.0	740.0	ND	60.0	ND	ND	ND	ND	ND
Little Colorado R. (blw S. Fk.)	ND	ND	ND	ND	ND	13.0	880.0	ND	70.0	ND	ND	ND	60.0	ND
Mamie Cr.	ND	ND	ND	ND	ND	18.0	650.0	ND	ND	ND	ND	ND	60.0	ND
Mineral Cr.	ND	ND	ND	ND	ND	ND	520.0	ND	ND	ND	ND	ND	ND	ND
Paddy Cr.	ND	ND	ND	ND	ND	ND	210.0	ND	ND	ND	ND	ND	ND	ND
Rudd Cr.	ND	ND	ND	ND	ND	13.0	290.0	ND	ND	ND	ND	ND	60.0	ND
S. Fk. Little Colorado R.	ND	ND	ND	ND	ND	13.0	ND	ND	ND	ND	ND	ND	50.0	ND
West Fk. Little Colorado R. (Lower)	ND	ND	ND	ND	ND	ND	150.0	ND	ND	ND	ND	ND	ND	ND
West Fk. Little Colorado R. (Upper)	ND	ND	ND	ND	ND	ND	180.0	ND	ND	ND	ND	ND	ND	ND
UPPER GILA BASIN														
Blue R. (Lower)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Blue R. (Upper)	ND	ND	ND	ND	ND	ND	140.0	ND	ND	ND	ND	ND	ND	ND
Campbell Blue R.	ND	ND	ND	ND	ND	ND	320.0	ND	ND	ND	ND	ND	ND	ND
Coleman Cr.	ND	ND	ND	ND	ND	ND	310.0	ND	ND	ND	ND	ND	ND	ND
Eagle Cr. (Honeymoon)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Eagle Cr. (Sheep Wash)	ND	ND	ND	ND	ND	ND	130.0	ND	ND	ND	ND	ND	ND	ND
East Turkey Cr.	ND	ND	ND	ND	ND	ND	450.0	ND	ND	ND	ND	ND	ND	ND
Frye Cr.	ND	ND	ND	ND	ND	17.0	340.0	ND	ND	ND	ND	ND	60.0	ND
Grant Cr. (Blue)	ND	ND	ND	ND	ND	ND	180.0	ND	ND	ND	ND	ND	ND	ND
Grant Cr. (Pinaleno)	ND	ND	ND	ND	ND	ND	300.0	ND	ND	ND	ND	ND	ND	ND
Lanphier Canyon	ND	ND	ND	ND	ND	10.0	170.0	ND	ND	ND	ND	ND	ND	ND
Marijilda Cr.	ND	ND	ND	ND	ND	11.0	200.0	ND	ND	ND	ND	ND	50.0	ND
San Francisco R. (Blue)	ND	ND	ND	ND	ND	ND	110.0	ND	ND	ND	ND	ND	ND	ND
South Fk Cave Cr.	ND	ND	ND	ND	ND	ND	650.0	ND	ND	ND	ND	ND	ND	ND
UPPER SALT BASIN														
Conklin Cr.	ND	ND	ND	ND	ND	ND	190.0	ND	ND	ND	ND	ND	ND	ND
East Fork Black R.	ND	ND	ND	ND	ND	ND	350.0	ND	ND	ND	ND	ND	ND	ND
Horton Cr.	ND	ND	ND	ND	ND	ND	180.0	ND	ND	ND	ND	ND	ND	ND
N. Fk. Bear Wallow Cr.	ND	ND	ND	ND	ND	ND	120.0	ND	ND	ND	ND	ND	ND	ND
Reservation Cr.	ND	ND	ND	ND	ND	ND	320.0	ND	ND	ND	ND	ND	ND	ND
West Fork Black R.	ND	ND	ND	ND	ND	10.0	520.0	ND	ND	ND	ND	ND	ND	ND

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	METALS	AS	BA	B	CD	CR	CU	FE	PB	MN	HG	SE	AG	ZN	TL
	UNITS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	DETECTION LEVEL	10.0	100.0	100.0	1.0	10.0	10.0	100.0	10.0	50.0	0.5	5.0	1.0	50.0	5.0
MIDDLE SALT BASIN															
Campaign Cr.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	50.0	ND
Canyon Cr.		ND	ND	ND	ND	ND	ND	230.0	ND	ND	ND	ND	ND	ND	ND
Cherry Cr. (Lower)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	50.0	ND
Cherry Cr. (Upper)		ND	ND	ND	ND	ND	ND	140.0	ND	ND	ND	ND	ND	50.0	ND
Deer Cr.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Greenback Cr.		ND	130.0	ND	ND	ND	ND	170.0	ND	ND	ND	ND	ND	ND	ND
Haigler Cr.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Reynolds Cr.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60.0	ND
Salome Cr.		ND	ND	ND	ND	ND	ND	200.0	ND	ND	ND	ND	ND	ND	ND
Spring Cr.		ND	120.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	50.0	ND
Tonto Cr. (Gisela)		ND	ND	ND	ND	ND	10.0	380.0	ND	ND	ND	ND	ND	ND	ND
Workman Cr.		ND	ND	ND	ND	ND	ND	340.0	ND	ND	ND	ND	ND	60.0	ND
SAN PEDRO/WILLCOX BASINS															
Aravaipa Canyon (East)		ND	ND	ND	ND	ND	ND	140.0	ND	ND	ND	ND	ND	ND	ND
Aravaipa Canyon (West)		ND	ND	ND	ND	ND	ND	200.0	ND	ND	0.8	ND	ND	50.0	ND
Bass Canyon		ND	ND	ND	ND	ND	ND	350.0	ND	ND	ND	ND	ND	ND	ND
Goudy Cr.		ND	ND	ND	ND	ND	14.0	380.0	ND	ND	ND	ND	ND	ND	ND
Hot Springs Canyon		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ramsey Canyon		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60.0	ND
Redfield Canyon		ND	ND	ND	ND	ND	ND	210.0	ND	ND	ND	ND	ND	ND	ND
San Pedro R.		ND	110.0	100.0	ND	ND	ND	350.0	ND	ND	ND	ND	ND	50.0	ND
Ward Canyon		ND	ND	ND	ND	ND	ND	220.0	ND	ND	ND	ND	ND	ND	ND
SANTA CRUZ BASIN															
Canada del Oro Cr.		ND	ND	ND	ND	ND	ND	160.0	ND	ND	ND	ND	ND	ND	ND
Cave Cr.		ND	ND	ND	ND	ND	11.0	450.0	ND	ND	ND	ND	ND	60.0	ND
Cienega Cr.		ND	160.0	130.0	ND	ND	11.0	220.0	ND	ND	ND	ND	ND	60.0	ND
Gardner Cr.		ND	ND	1910.0	ND	ND	ND	230.0	ND	ND	ND	ND	ND	50.0	ND
Madera Cr.		ND	ND	ND	ND	ND	11.0	220.0	ND	ND	ND	ND	ND	60.0	ND
Sabino Cr.		ND	ND	ND	ND	ND	ND	390.0	ND	ND	ND	ND	ND	60.0	ND
Santa Cruz R.		ND	130.0	ND	ND	ND	ND	110.0	ND	ND	ND	ND	ND	50.0	ND
RIO DE MEXICO BASINS															
Rucker Cr.		ND	ND	ND	ND	ND	ND	200.0	ND	ND	ND	ND	ND	50.0	ND
Sycamore Cr. (Sonora)		ND	ND	ND	ND	ND	18.0	480.0	ND	ND	ND	ND	ND	50.0	ND

Appendix F. Chemistry results for surface water samples collected at Arizona reference sites in 1992.

SAMPLE SITES - 1992	AS	BA	B	CD	CR	CU	FE	PB	MN	HG	SE	AG	ZN	TL
METALS	AS	BA	B	CD	CR	CU	FE	PB	MN	HG	SE	AG	ZN	TL
UNITS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
DETECTION LEVEL	10.0	100.0	100.0	1.0	10.0	10.0	100.0	10.0	50.0	0.5	5.0	1.0	50.0	5.0
VERDE BASIN														
Black Canyon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	50.0	ND
East Verde R. (Brushy Canyon)	ND	ND	ND	ND	ND	ND	190.0	ND	ND	ND	ND	ND	ND	ND
East Verde R. (Ellison)	ND	ND	ND	ND	ND	ND	130.0	ND	ND	ND	ND	ND	ND	ND
Oak Cr. (Baldwin Crossing)	ND	200.0	ND	ND	ND	ND	150.0	ND	ND	ND	ND	ND	60.0	ND
Oak Cr. (Chavez Crossing)	ND	220.0	ND	ND	ND	ND	240.0	ND	ND	ND	ND	ND	60.0	ND
Oak Cr. (Grasshopper Pt.)	ND	220.0	ND	ND	ND	ND	170.0	ND	ND	ND	ND	ND	ND	ND
Oak Cr. (Pine Flat)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	50.0	ND
Oak Cr. (Red Rock)	ND	190.0	ND	ND	ND	ND	160.0	ND	ND	ND	ND	ND	50.0	ND
Pine Cr.	ND	ND	ND	ND	ND	37.0	110.0	ND	ND	ND	ND	ND	ND	ND
Roundtree Cr.	ND	ND	ND	ND	ND	ND	200.0	ND	ND	ND	ND	ND	60.0	ND
Sycamore Cr. (Horseshoe)	20.0	ND	ND	ND	ND	14.0	250.0	ND	ND	ND	ND	ND	50.0	ND
Sycamore Cr. (Mazatzal)	ND	ND	ND	ND	ND	ND	190.0	ND	ND	ND	ND	ND	50.0	ND
Verde R. (Perkinsville)	24.0	ND	270.0	ND	ND	ND	380.0	ND	ND	ND	ND	ND	ND	ND
Webber Cr.	ND	ND	ND	ND	ND	ND	130.0	ND	ND	ND	ND	ND	50.0	ND
West Clear Cr. (Lower)	ND	170.0	ND	ND	ND	ND	130.0	ND	ND	ND	ND	ND	ND	ND
West Clear Cr. (Upper)	ND	ND	ND	ND	ND	ND	120.0	ND	ND	LT	ND	ND	50.0	ND
West Fork Oak Cr.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60.0	ND
Wet Beaver Cr.	13.0	260.0	ND	ND	ND	ND	190.0	ND	ND	ND	ND	ND	ND	ND
MIDDLE GILA BASIN														
Agua Fria R.	ND	ND	ND	ND	ND	ND	220.0	ND	ND	ND	LT	ND	90.0	ND
Antelope Cr.	ND	ND	ND	ND	ND	ND	120.0	ND	ND	LT	ND	ND	50.0	ND
Ash Cr.	ND	ND	ND	ND	ND	12.0	410.0	ND	ND	ND	ND	ND	50.0	ND
Hassayampa R. (Upper)	ND	ND	ND	1.1	ND	ND	220.0	ND	60.0	ND	ND	ND	110.0	ND
Lion Canyon	ND	140.0	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND
Little Ash Cr.	ND	ND	ND	ND	ND	ND	100.0	ND	ND	ND	LT	ND	70.0	ND
Poland Cr.	ND	ND	ND	ND	ND	ND	ND	ND	ND	LT	ND	ND	70.0	ND
Sycamore Cr. (Dugas)	ND	ND	ND	ND	ND	ND	100.0	ND	ND	ND	LT	ND	60.0	ND
BILL WILLIAMS BASIN														
Burro Cr.	ND	ND	110.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	50.0	ND
Conger Cr.	ND	ND	ND	ND	ND	ND	100.0	ND	ND	ND	ND	ND	50.0	ND
Francis Cr.	ND	ND	100.0	ND	ND	ND	200.0	ND	ND	ND	ND	ND	470.0	ND
Peeples Canyon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	300.0	ND
Santa Maria R.	ND	ND	200.0	ND	ND	18.0	340.0	ND	ND	ND	ND	ND	60.0	ND
Trout Cr.	13.0	ND	180.0	ND	ND	ND	290.0	ND	ND	ND	LT	ND	80.0	ND
NORTHERN COLORADO MAINSTEM														
Bright Angel Cr.	ND	NA	NA	ND	ND	ND	NA	3.0	NA	ND	ND	ND	10.0	ND
Havasu Cr.	10.0	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	ND	14.0	ND
Hermit Cr.	ND	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	ND	ND	ND
Kanab Cr.	ND	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	ND	186.0	ND
Matkatamiba Cr.	ND	NA	NA	ND	ND	ND	NA	ND	NA	ND	10.0	ND	128.0	ND
Nankoweap Cr.	ND	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	ND	12.0	ND
Paria R.	8.0	NA	NA	ND	29.0	38.0	NA	8.0	NA	ND	ND	ND	85.0	ND
Royal Arch Cr.	ND	NA	NA	ND	ND	ND	NA	ND	NA	ND	6.0	ND	106.0	ND
Spring Canyon	8.0	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	ND	ND	ND
Tapeats Cr.	ND	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	ND	ND	ND

APPENDIX G.

Physical and chemical characteristics and summary statistics for Arizona reference sites within each of three clusters, 1992.
(G1-G4)

Appendix G Physical and Chemical Characteristics and Summary Statistics for Arizona Reference Sites within each of three clusters, 1992.

	ADEQ SITE ID	MAJOR BASIN	ECO-REGION	Temp	DO	pH	TURB	ALK-T	HARD	TDS	WATERSHE AREA (sq.k	ELEVATION (feet)	GRADIENT (ft/ft)*	P/R	Htot	Relief
CLUSTER 1 OF 3																
1	ARA2-00	SPR	SD	21	8.5	8.8	9.3	156	157	265	1278	2650	0.006	0.25	145	0.023
2	ASH1-00	MG	AZNMM	16	8.3	7.8	4.5	176	170	213	9	6100	0.053	1.86	151	0.055
3	BAR2-00	LCR	AZNMM	15	7.9	7.7	1.0	65	76	90	54	6520	0.021	2.33	160	0.020
4	BAS1-00	SPR	SD	16	8.0	7.1	5.9	37	42	103	87	4040	0.021	1.00	163	0.063
5	BLC1-00	VER	AZNMM	15	8.1	8.0	0.5	200	202	247	12	6000	0.042	0.18	138	0.084
6	BLU1-00	UG	AZNMM	19	7.1	8.1	3.1	127	123	184	298	6110	0.009	0.67	131	0.056
7	BLU4-00	UG	AZNMM	17	8.4	8.1	0.8	158	165	291	1268	4310	0.009	0.67	143	0.022
8	BRA1-00	NC	AZNMP	16	8.8	8.6	3.3	161	210	150	268	2520	0.027	0.01	113	0.000
9	CDO1-00	SCR	SBR	18	8.0	8.0	0.6	49	50	108	39	4600	0.040	1.86	149	
10	CGN1-00	MS	AZNMM	20	8.4	8.4	0.4	195	196	289	25	3355	0.044	1.00	159	0.088
11	CHE1-00	MS	AZNMM	25	9.0	8.5	1.6	163	164	202	250	4390	0.009	2.33	105	0.017
12	CHE2-00	MS	AZNMM	19	8.5	8.4	1.1	175	179	213	447	3190	0.013	0.67	144	0.021
13	CHV2-00	LCR	AZNMM	17	7.0	6.9	0.9	65	67	84	121	6535	0.008	2.33	165	0.017
14	CHV3-00	LCR	AZNMM	17	7.7	8.2	1.3	105	107	119	153	6470	0.006	1.00	156	0.016
15	DEE1-00	MS	AZNMM	13	9.9	8.1	0.6	86	87	130	21	3630	0.059	1.00	147	0.131
16	EAG1-00	UG	AZNMM	21	7.0	8.3	0.7	127	115	190	262	5435	0.017	0.67	154	0.059
17	EAG3-00	UG	AZNMM	28	7.1	7.1	3.2	130	117	195	985	4645	0.008	0.67	145	0.032
18	EVD1-00	VER	AZNMM	20	8.3	8.5	2.2	267	283	271	136	5165	0.013	1.50	165	0.049
19	GRB1-00	UG	AZNMM	14	8.6	8.0	3.0	72	70	114	48	5580	0.038	0.11	138	
20	HAI1-00R	MS	AZNMM	16	8.6	8.3	0.5	199	196	220	92	4870	0.044	5.67	147	0.048
21	HSC1-00	SPR	SD	16	9.1	8.4	1.5	89	63	141	246	3830	0.009	0.25	140	0.055
22	KAN1-00	NC	AZNMP	23		7.3	2.3	108	210	900	5987	1880	0.011	1.00	122	0.000
23	MAD1-00	SCR	SD	10	9.3	7.8	1.1	116	160	246	3	6060	0.191	1.22	159	
24	NAN1-00	NC	AZNMP	25	7.1	8.6	21.6	212	260	290	91	2800	0.072	0.00	81	0.000
25	PIN1-00R	VER	AZNMM	17	7.8	8.3	0.4	209	205	243	119	3360	0.021	0.67	138	
26	RED1-00	SPR	SD	16	8.8	7.6	3.6	51	64	136	95	3900	0.025	0.67	153	
27	ROY1-00	NC	AZNMP	17	9.0	8.5	1.6	148	210	500	40	2160	0.250	0.33	116	0.000
28	SAB1-00	SCR	SBR	17	8.8	7.3	4.3	20	24	80	47	3720	0.045	2.33	159	0.117
29	SAL1-00	MS	AZNMM	20	8.4	8.5	2.2	80	86	124	50	4820	0.021	9.00	134	0.070
30	SPR1-00	SPR	SD	16	10.0	8.8	14.2	194	171	300	3196	3920	0.003	1.00	110	
31	SYH1-00	VER	AZNMM	17	7.4	7.9	0.4	165	143	237	76	2080	0.023	1.86	150	0.081
32	SYM1-00	VER	AZNMM	20	7.3	8.1	0.5	181	169	250	291	2060	0.008	1.50	131	0.051
33	SYS1-00	SON	SD	18	6.8	6.9	3.6	49	47	137	29	3790	0.021	0.33	137	
34	TAP1-00	NC	AZNMP	15	9.5	8.6	2.4	162	210	150	218	2000	0.042	0.00	114	0.000
35	TON1-00	MS	AZNMM	14	9.3	7.5	5.9	87	95	121	1062	2950	0.013	1.50	135	
36	VER1-00	VER	AZNMM	19	8.6	8.4	10.0	251	184	319	6614	3820	0.003	0.67	135	0.011
37	WBV1-00	VER	AZNMM	18	7.6	8.2	0.6	125	115	143	287	4025	0.025	1.50	170	0.038
38	WCC3-00	VER	AZNMM	16	8.4	8.2	0.6	180	177	196	579	3660	0.011	1.00	159	0.024
	MIN			10	6.8	6.9	0.4	20	24	80	3	1880	0.003	0.00	81	0.000
	MAX			28	10.0	8.8	21.6	267	283	900	6614	6535	0.250	9.00	170	0.131
	MEAN			18	8.3	8.0	3.2	135	141	216	655	4130	0.034	1.33	141	0.042
	STD			3	0.8	0.5	4.2	61	64	140	1452	1372	0.048	1.62	19	0.034

Appendix G Physical and Chemical Characteristics and Summary Statistics for Arizona Reference Sites within each of three clusters, 1992.

	ADEQ SITE ID	MAJOR BASIN	ECO-REGION	Temp	DO	pH	TURB	ALK-T	HARD	TDS	WATERSHE AREA (sq.k	ELEVATION (feet)	GRADIENT (ft/ft)*	P/R	Htot	Relief
	CLUSTER 2 OF 3															
1	AGF1-00	MG	AZNMM	20	9.8	8.3	1.3	241	313	499	1522	3445	0.008	2.33	118	0.024
2	ANT1-00	MG	SBR	18	9.1	8.5	1.2	296	282	390	13	3850	0.053	1.50	136	0.172
3	ARA1-00	SPR	SD	16	8.2	8.3	25.0	160	150	244	1037	2980	0.006	0.11	114	0.025
4	BUR1-00	BW	SBR	25	8.7	8.3	1.6	210	165	270	438	3100	0.013	1.86	140	0.039
5	CGR1-00	BW	SBR	23	6.6	8.0	0.2	157	144	241	39	4360	0.068	1.50	157	0.037
6	CIE1-00R	SCR	SD	19	11.8	8.7	3.7	193	145	252	516	4050	0.008	0.43	136	0.044
7	FRA1-00	BW	SBR	22	9.2	8.0	2.4	156	134	257	330	3250	0.019	1.50	150	0.047
8	HER1-00	NC	AZNMP	24	7.5	8.8	1.4	192	210	210	25	2920	0.246	0.11	118	0.000
9	LAC1-00	MG	AZNMM	16	5.8	7.5	1.6	230	230	328	113	3840	0.017	1.50	130	0.051
10	PEE1-00	BW	SBR	23	8.0	7.6	0.2	157	146	290	15	2480	0.057	4.00	150	0.073
11	ROU1-00	VER	AZNMM	20	7.9	8.6	0.3	248	226	331	29	3300	0.030	2.33	149	0.059
12	SCR1-00	SCR	SD	14	9.5	8.1	1.8	155	146	210	253	4630	0.004	0.18	93	
13	SMR1-00	BW	SBR	24	8.7	8.7	1.5	166	147	375	1996	1830	0.011	9.00	62	0.017
14	SPC1-00	NC	AZNMP	27	6.1	8.3	0.6	184	210	420	57	1500	0.053	0.05	147	0.000
15	SPG1-00	MS	AZNMM	20	8.0	8.1	1.8	181	181	180	227	4260	0.013	4.00	127	0.057
16	SYD1-00	MG	AZNMM	16	9.1	8.2	1.1	225	229	332	93	4090	0.017	3.00	136	0.045
17	TRT1-00R	BW	AZNMP	22	8.1	8.8	6.5	216	146	306	1331	3230	0.027	3.00	144	0.021
	MIN			14	5.8	7.5	0.2	155	134	180	13	1500	0.004	0.05	62	0.000
	MAX			27	11.8	8.8	25.0	296	313	499	1996	4630	0.246	9.00	157	0.172
	MEAN			20	8.4	8.3	3.1	198	188	302	473	3360	0.038	2.14	130	0.045
	STD			3	1.4	0.4	5.7	39	52	81	597	837	0.055	2.12	23	0.039

Appendix G Physical and Chemical Characteristics and Summary Statistics for Arizona Reference Sites within each of three clusters, 1992.

	ADEQ SITE ID	MAJOR BASIN	ECO-REGION	Temp	DO	pH	TURB	ALK-T	HARD	TDS	WATERSHE AREA (sq.k	ELEVATION (feet)	GRADIENT (ft/ft)*	P/R	Htot	Relief
CLUSTER 3 OF 3																
1	BAR1-00	LCR	AZNMM	13	7.2	7.6	1.2	94	96	107	54	6520	0.021	4.00	148	0.025
2	CKN1-00	US	AZNMM	11	8.5	7.9	2.9	35	37	60	19	7200	0.049	0.43	159	0.064
3	CMB1-00	UG	AZNMM	20	6.4	7.9	3.9	81	70	116	122	6670	0.017	0.43	122	
4	COL1-00	UG	AZNMM	9	8.6	7.7	4.8	51	54	97	24	7850	0.038	0.43	166	0.073
5	CYN1-00	MS	AZNMM	11	9.4	8.4	4.2	92	96	118	74	6270	0.013	1.86	156	0.045
6	ECL1-00	LCR	AZNMM	19	7.5	8.4	1.4	129	135	142	270	6450	0:004	4.00	153	0.014
7	EFB1-00	US	AZNMM	15	8.2	8.8	3.5	49	43	71	264	7920	0.015	0.67	153	0.019
8	ELC1-00	LCR	AZNMM	18	6.8	7.5	4.8	20	16	50	4	9440	0.023	0.25	141	0.095
9	ETK1-00	UG	SD	8	10.0	8.2	8.6	28	39	82	5	6520	0.136	0.43	150	0.251
10	FRY1-00	UG	SD	9	8.1	7.5	1.2	21	25	47	10	5800	0.121	0.67	174	0.233
11	GRP1-00	UG	SD	5	9.4	7.6	5.2	14	20	40	25	5600	0.114	0.25	153	0.190
12	HOR1-00	US	AZNMM	7	9.4	8.3	1.7	33	36	73	10	7995	0.047	0.33	162	0.076
13	LAN1-00	UG	AZNMM	15	8.2	6.8	1.6	92	91	144	27	5725	0.047	0.43	150	
14	LCR1-00	LCR	AZNMM	17	7.4	7.0	7.6	37	30	82	176	7490	0.049	0.67	162	0.055
15	LIL1-00R	LCR	AZNMM	11	8.1	8.1	3.2	90	90	151	1	8620	0.114	0.43	155	0.250
16	MAM1-00	LCR	AZNMM	8	8.4	7.6	8.3	49	56	112	5	8590	0.061	0.11	151	0.144
17	MAR1-00	UG	SD	6	9.5	7.5	1.4	19	24	47	13	5520	0.144	1.00	166	0.242
18	MIN1-00R	LCR	AZNMM	12	8.2	7.8	5.6	45	43	78	16	8070	0.072	0.43	154	0.054
19	NBW1-00	US	AZNMM	8	7.8	7.6	1.7	28	28	62	16	7740	0.045	1.00	163	0.070
20	OAK1-00	VER	AZNMM	17	9.0	8.7	0.5	126	120	141	223	5550	0.027	4.00	154	0.039
21	PAD1-00	LCR	AZNMM	9	8.4	7.9	1.5	53	52	94	11	8485	0.047	0.25	153	0.105
22	RAM1-00	SPR	SD	10	9.8	8.2	0.4	177	191	217	7	6175	0.114	0.43	165	
23	RES1-00	US	AZNMM	11	9.1	7.6	3.1	23	19	60	59	6790	0.042	0.11	143	0.055
24	REY1-00	MS	AZNMM	17	8.1	8.3	0.8	188	193	238	37	5065	0.028	1.50	155	0.084
25	RUC1-00	YAQ	SD	8	9.2	7.2	4.1	7	14	53	19	6220	0.030	0.43	153	0.116
26	RUD1-00	LCR	AZNMM	12	7.8	7.9	4.9	89	78	96	13	8100	0.049	0.33	145	0.080
27	SFC1-00	UG	SD	9	9.1	7.7	8.2	16	27	80	29	5510	0.030	0.25	161	0.131
28	SLC1-00	LCR	AZNMM	14	7.3	7.8	0.6	97	77	130	60	7620	0.040	0.33	149	0.508
29	WAR1-00	SPR	SD	9	9.0	7.2	3.3	16	27	81	8	6260	0.091	0.18	145	0.248
30	WCC1-00	VER	AZNMM	12	9.2	8.3	1.1	109	114	132	350	5985	0.009	2.33	164	0.023
31	WEB1-00	VER	AZNMM	11	9.3	8.0	3.4	133	138	162	27	5380	0.025	0.54	164	0.122
32	WFB1-00	US	AZNMM	8	9.4	7.5	4.5	22	22	53	90	7800	0.015	0.43	152	0.057
33	WFO1-00	VER	AZNMM	12	9.0	8.1	1.5	183	187	202	111	5310	0.027	4.00	143	0.052
34	WLC1-00	LCR	AZNMM	11	7.1	7.4	1.6	14	5	10	14	9240	0.013	0.25	148	0.104
35	WLC2-00	LCR	AZNMM	15	8.3	7.0	1.3	23	17	39	29	8550	0.027	0.33	163	0.071
36	WOR1-00	MS	AZNMM	13	8.6	8.3	3.8	135	139	186	7	6160	0.098	1.86	153	0.215
	MIN			5	6.4	6.8	0.4	7	5	10	1	5065	0.004	0.11	122	0.014
	MAX			20	10.0	8.8	8.6	188	193	238	350	9440	0.144	4.00	174	0.508
	MEAN			12	8.5	7.8	3.3	67	68	101	62	6950	0.051	0.98	154	0.118
	STD			4	0.9	0.5	2.3	52	53	53	86	1216	0.039	1.18	9	0.100

Appendix G Physical and Chemical Characteristics and Summary Statistics for Arizona Reference Sites within each of three clusters, 1992.

ADEQ SITE ID	MAJOR BASIN	ECO-REGION	Temp	DO	pH	TURB	ALK-T	HARD	TDS	WATERSHE AREA (sq.k	ELEVATION (feet)	GRADIENT (ft/ft)*	P/R	Htot	Relief
Cluster and Ecoregion summary															
		Cluster 1	18	8.3	8.0	3.2	135	141	216	655	4130	0.034	1.33	141	0.042
		Cluster 2	20	8.4	8.3	3.1	198	188	302	473	3360	0.038	2.14	130	0.045
		Cluster 3	12	8.5	7.8	3.3	67	68	101	62	6950	0.051	0.98	154	0.118
		AZNMM	15	8.2	8.0	2.4	120	118	164	305	5800	0.029	1.50	148	0.072
		AZNMP	21	8.0	8.4	5.0	173	208	366	1002	2376	0.091	0.56	119	0.003
		SBR	21	8.4	8.1	1.5	151	137	251	365	3399	0.038	2.94	138	0.072
		SD	13	9.1	7.9	5.7	83	84	149	381	4859	0.060	0.50	145	0.135

APPENDIX H.

Cluster summary of percent composition by insect orders and of thirteen metric scores for macroinvertebrate communities at Arizona reference sites in 1992. (H1-H10)

APPENDIX H CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND OF THIRTEEN METRIC SCORES COLLECTED FROM ARIZONA REFERENCE SITES IN 1992.

	PERCENT COMPOSITION BY ORDER									
	MISC	ODONAT	EPHEM	PLECOP	HEMIP	MEGALO	TRICHOP	LEPIDOP	COLEOP	DIPTERA
CLUSTER 1										
ARA2	4.5	3.4	25.2	0.0	0.2	1.6	10.0	0.0	8.8	46.2
ASH1	16.0	2.5	9.9	2.5	0.0	0.0	3.9	0.0	9.0	56.2
BAR2	10.4	0.0	17.0	0.9	0.0	0.0	3.2	0.0	3.7	64.7
BAS1	9.5	1.5	14.5	0.0	1.3	1.3	14.4	0.0	3.5	54.2
BLC1	9.9	0.0	7.2	9.7	0.0	4.6	0.6	0.0	4.9	63.2
BLU1	5.7	1.6	14.6	4.9	0.7	2.8	18.7	0.0	11.4	39.6
BLU4	8.7	0.9	23.3	0.0	0.0	2.9	13.5	1.2	10.1	39.4
BRA1	11.3	2.4	12.4	0.0	0.0	1.8	17.0	2.5	7.3	45.4
CDO1	7.0	1.1	8.2	0.0	0.0	2.2	4.5	0.0	8.5	68.4
CGN1	7.2	4.6	12.8	0.0	2.5	1.2	12.0	0.0	10.5	49.1
CHE1	10.0	4.5	19.6	0.0	2.0	0.7	14.3	0.0	5.2	43.7
CHE2	7.6	1.8	15.8	0.0	0.0	1.6	8.2	1.4	2.1	61.5
CHV2	13.5	3.7	23.5	3.7	0.0	0.0	7.6	0.0	6.2	41.7
CHV3	11.8	4.7	24.9	0.0	0.0	0.0	11.7	3.0	7.6	36.3
DEE1	11.0	3.5	11.8	5.2	0.0	3.4	6.0	0.0	4.3	54.8
EAG1	18.1	2.0	14.6	0.0	0.0	2.2	17.6	0.0	4.2	41.3
EAG3	5.6	0.5	32.7	0.0	0.0	1.7	12.9	1.8	6.7	38.3
EVD1	7.0	5.4	19.0	2.0	4.9	0.0	7.5	0.0	11.8	42.5
GRB1	3.1	2.1	17.6	3.4	1.1	0.8	23.9	0.8	6.9	40.4
HAI1	10.9	4.1	11.7	0.0	1.6	1.0	28.9	0.5	10.4	30.9
HSC1	10.0	4.0	17.4	0.0	0.0	1.3	11.7	0.0	2.0	53.6
KAN1	11.4	5.0	10.4	0.0	4.1	2.8	12.9	0.7	3.5	49.2
MAD1	6.3	1.0	8.3	0.3	0.0	2.7	13.9	0.0	4.9	62.5
NAN1	7.0	10.3	16.1	0.0	0.0	1.5	8.3	0.0	5.7	51.0
PIN1	13.5	2.5	21.8	4.7	1.4	2.5	9.4	0.0	8.2	36.1
RED1	9.4	5.6	16.6	0.0	0.0	3.8	9.6	0.0	11.8	43.1
ROY1	15.8	4.7	5.8	0.0	0.0	2.1	9.9	0.0	4.1	57.5
SAB1	5.3	4.1	23.4	4.1	0.0	0.0	1.3	0.0	10.5	51.1
SAL1	11.7	6.8	9.5	0.0	2.5	0.8	12.6	0.0	9.2	46.9
SPR1	12.0	5.3	13.7	0.0	1.1	0.0	11.6	1.5	6.4	48.5
SYH1	10.4	6.2	12.2	0.0	0.8	0.0	12.1	0.0	6.8	51.5
SYM1	11.9	5.2	15.3	0.0	4.0	0.0	7.9	0.0	7.9	47.9
SYS1	13.5	5.3	9.7	0.0	2.0	0.6	10.0	0.0	6.1	52.8
TAP1	9.1	0.0	11.7	7.0	0.0	0.0	11.9	0.0	2.5	57.9
TON1	5.6	3.1	25.6	1.3	0.4	1.9	8.8	1.3	8.5	43.4
VER1	10.2	1.3	25.8	1.2	2.1	1.2	21.1	0.0	12.1	24.8
WBV1	15.3	3.1	12.4	0.0	1.4	1.7	7.5	2.1	11.2	45.3
WCC3	11.4	5.0	13.7	1.3	0.0	1.8	8.1	1.6	12.3	44.9
MIN	3.1	0.0	5.8	0.0	0.0	0.0	0.6	0.0	2.0	24.8
MAX	18.1	10.3	32.7	9.7	4.9	4.6	28.9	3.0	12.3	68.4
AVG	10.0	3.4	15.9	1.4	0.9	1.4	11.2	0.5	7.3	48.1
STD	3.4	2.2	6.1	2.3	1.3	1.2	5.7	0.8	3.0	9.4

APPENDIX H CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND OF THIRTEEN METRIC SCORES COLLECTED FROM ARIZONA REFERENCE SITES IN 1992.

	PERCENT COMPOSITION BY ORDER									
	MISC	ODONAT	EPHEM	PLECOP	HEMIP	MEGALO	TRICHOP	LEPIDOP	COLEOP	DIPTERA
CLUSTER 2										
AGF1	9.7	6.2	8.8	1.6	0.0	1.0	14.3	0.0	11.8	46.7
ANT1	8.1	4.3	10.6	0.0	2.4	1.3	9.2	0.0	12.3	51.7
ARA1	7.3	2.3	16.1	0.0	0.2	0.0	6.4	0.0	6.3	61.4
BUR1	3.7	4.1	18.2	0.0	1.4	0.0	15.4	0.0	2.5	54.7
CGR1	10.4	7.1	13.3	0.0	3.8	0.4	21.3	0.6	5.3	37.8
CIE1	19.6	9.6	10.5	0.0	1.6	0.0	12.3	2.1	14.0	30.3
FRA1	10.9	5.7	12.2	2.1	1.9	0.0	15.4	0.9	8.9	42.0
HER1	10.1	12.5	7.3	0.0	0.4	3.1	15.1	0.0	6.2	45.4
LAC1	10.5	3.4	13.7	0.0	1.5	1.3	16.3	0.0	6.0	47.3
PEE1	4.8	7.6	15.5	0.0	2.8	1.4	10.0	0.0	12.6	45.2
ROU1	6.3	6.8	13.7	0.0	3.1	1.1	9.9	0.0	17.9	41.2
SCR1	25.3	8.7	10.9	0.0	6.0	0.0	9.0	0.0	15.1	24.9
SMR1	6.0	2.1	16.7	0.0	1.7	1.5	10.9	0.4	3.0	57.7
SPG1	7.6	0.6	19.7	0.0	2.9	2.8	15.7	0.6	10.8	39.4
SYD1	6.6	1.7	11.8	0.0	1.1	0.7	13.6	0.7	9.1	54.7
TRT1	6.9	1.6	15.7	0.0	0.0	0.4	13.2	0.0	12.9	49.3
MIN	3.7	0.6	7.3	0.0	0.0	0.0	6.4	0.0	2.5	24.9
MAX	25.3	12.5	19.7	2.1	6.0	3.1	21.3	2.1	17.9	61.4
AVG	9.6	5.3	13.4	0.2	1.9	0.9	13.0	0.3	9.7	45.6
STD	5.4	3.2	3.3	0.6	1.5	0.9	3.5	0.6	4.3	9.4

APPENDIX H CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND OF THIRTEEN METRIC SCORES COLLECTED FROM ARIZONA REFERENCE SITES IN 1992.

	PERCENT COMPOSITION BY ORDER									
	MISC	ODONAT	EPHEM	PLECOP	HEMIP	MEGALO	TRICHOP	LEPIDOP	COLEOP	DIPTERA
CLUSTER 3										
BAR1	5.3	3.9	16.7	3.5	3.9	0.0	16.2	0.0	5.2	45.2
CKN1	5.0	3.1	9.6	6.9	1.4	0.0	13.7	0.0	10.4	49.9
CMB1	5.8	2.9	15.4	2.6	3.2	0.0	27.0	1.4	9.0	32.7
COL1	6.8	1.1	17.5	7.1	0.0	0.0	17.8	0.0	10.7	39.0
CYN1	14.6	0.0	17.7	0.0	2.2	0.0	18.7	1.2	11.7	33.8
ECL1	18.0	2.5	15.1	0.7	2.7	0.0	12.0	1.2	11.5	36.3
EFB1	15.3	1.2	12.5	2.4	3.3	0.0	9.3	2.2	8.8	45.1
ELC1	10.8	0.0	11.6	3.4	0.0	0.0	19.2	0.0	7.3	47.7
ETK1	6.4	4.9	12.2	4.2	0.4	0.0	18.3	0.0	6.6	47.0
FRY1	3.8	3.3	21.9	2.5	0.0	1.0	15.5	0.0	3.9	48.0
GRP1	8.3	0.0	16.6	4.5	0.0	0.0	15.1	0.0	2.2	53.4
HOR1	9.8	0.0	21.0	10.2	0.0	0.0	12.0	0.0	10.7	36.3
LAN1	5.9	5.3	13.3	2.8	1.0	0.0	13.1	0.2	3.6	54.9
LCR1	12.7	0.0	22.0	13.0	0.0	0.0	17.4	1.9	13.6	19.3
LIL1	16.7	0.0	12.3	11.3	0.0	0.0	11.0	0.0	10.5	38.1
MAM1	13.1	0.0	14.2	9.4	0.0	0.0	13.3	0.0	11.1	38.9
MAR1	5.4	1.4	12.8	3.7	0.0	0.0	18.5	0.0	3.6	54.7
MIN1	12.1	0.6	10.2	3.8	1.5	0.3	16.5	0.0	7.1	48.0
NBW1	5.8	0.0	18.7	6.8	0.0	0.0	22.8	0.0	10.3	35.7
OAK1	11.6	5.7	23.8	0.0	0.0	0.0	15.5	0.0	6.9	36.5
PAD1	9.6	0.6	18.9	9.6	0.0	0.0	10.0	0.0	11.3	40.0
RAM1	7.1	7.6	5.5	3.8	0.0	0.0	16.2	0.0	7.1	52.7
RES1	8.6	0.0	17.8	4.6	1.8	0.0	21.6	0.0	11.7	33.9
REY1	4.9	1.6	18.2	3.4	1.6	0.8	21.7	0.0	3.8	44.0
RUC1	6.6	0.8	12.8	5.5	0.0	1.4	10.0	0.0	2.0	60.9
RUD1	9.3	0.4	14.7	4.5	1.8	0.0	15.5	0.0	9.9	43.9
SFC1	6.3	0.8	15.9	1.8	0.0	2.3	11.5	0.0	2.2	59.3
SLC1	8.1	0.0	22.8	7.9	2.6	0.0	14.9	0.0	10.8	32.9
WAR1	4.4	4.3	10.8	2.9	0.7	0.0	14.9	0.0	3.2	58.8
WCC1	6.4	1.6	23.9	2.9	0.0	1.1	14.9	0.8	15.7	32.7
WEB1	3.3	1.0	20.0	0.8	1.7	1.1	8.4	0.8	9.3	53.5
WFB1	10.1	0.0	16.3	4.5	3.1	0.0	19.4	0.4	7.4	38.7
WFO1	12.0	1.7	15.3	0.5	2.4	0.0	17.9	0.0	8.6	41.6
WLC1	12.0	0.0	25.3	9.0	0.0	0.0	14.7	0.0	8.4	30.6
WLC2	16.1	0.0	14.0	9.8	0.0	0.0	11.9	0.0	15.1	33.1
WOR1	7.9	3.4	13.1	7.8	0.0	0.0	13.9	0.0	6.3	47.6
MIN	3.3	0.0	5.5	0.0	0.0	0.0	8.4	0.0	2.0	19.3
MAX	18.0	7.6	25.3	13.0	3.9	2.3	27.0	2.2	15.7	60.9
AVG	9.0	1.7	16.1	4.9	1.0	0.2	15.6	0.3	8.3	42.9
STD	3.9	2.0	4.4	3.3	1.2	0.5	4.0	0.6	3.6	9.4

APPENDIX H CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND OF THIRTEEN METRIC SCORES COLLECTED FROM ARIZONA REFERENCE SITES IN 1992.

	PERCENT COMPOSITION BY ORDER									
	MISC	ODONAT	EPHEM	PLECOP	HEMIP	MEGALO	TRICHOP	LEPIDOP	COLEOP	DIPTERA
	MISC	ODONAT	EPHEM	PLECOP	HEMIP	MEGALO	TRICHOP	LEPIDOP	COLEOP	DIPTERA
Cluster 1	10.0	3.4	15.9	1.4	0.9	1.4	11.2	0.5	7.3	48.1
Cluster 2	9.6	5.3	13.4	0.2	1.9	0.9	13.0	0.3	9.7	45.6
Cluster 3	9.0	1.7	16.1	4.9	1.0	0.2	15.6	0.3	8.3	42.9

	TOT RICH	EPT RICH	EPT/CHI	%CHIRO	%TANYTA	%SIMULII	DIVERSIT	HBI INDE	SC/CF RA	SHREDD	%HYDROPS	%BAETIDAE
CLUSTER 1	48.1	11.0	16.3	34.6	0.7	4.6	2.4	5.8	0.7	0.0	32.5	39.7
CLUSTER 2	56.9	12.4	24.1	32.9	1.0	2.5	2.4	6.3	1.3	0.0	33.9	34.0
CLUSTER 3	56.9	17.4	21.5	28.6	0.8	3.9	2.5	5.2	7.9	0.4	14.8	28.0

APPENDIX H CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND OF THIRTEEN METRIC SCORES COLLECTED FROM ARIZONA REFERENCE SITES IN 1992.

	METRICS											
	TOT RICH	EPT RICH	EPT/CHI	%CHIRONOMID	%TANYTARSI	%SIMULIIDAE	DIVERSITY	HBI INDEX	SCRAPER/ COLLECTO	SHREDD RATIO	%HYDROPSYCHID TRICHOPTERA	%BAETIDAE/ EPHEMEROPTE
CLUSTER 1												
ARA2	53	12	23	37	0.0	0.0	2.7	5.1	1.28	0.00	64	24
ASH1	24	4	7.4	49.0	0.0	0.0	2.49	7.05	0.00	0.02	0.0	0.0
BAR2	55	10	23	51	1.6	3.5	2.8	5.7	1.01	0.00	0	23
BAS1	57	13	23	41	0.0	2.6	1.9	6.4	0.68	0.00	13	28
BLC1	40	7	6	46	0.0	8.7	1.6	5.9	0.06	0.08	0	0
BLU1	48	13	14	19	0.0	4.7	2.4	5.8	3.48	0.00	47	44
BLU4	40	13	16	26	0.9	7.2	2.0	5.0	0.54	0.00	54	37
BRA1	37	8	11.3	37.4	0.0	7.5	2.07	5.86	0.91	0.00	26.9	100.0
CDO1	36	4	10	58	1.6	6.0	2.3	5.2	0.00	0.00	54	73
CGN1	68	14	21	32	0.0	3.1	2.6	6.6	1.05	0.00	19	22
CHE1	50	13	22	32	0.0	1.5	2.3	6.1	0.06	0.00	54	36
CHE2	53	9	21.0	48.4	2.6	4.0	3.01	5.66	0.12	0.00	88.7	40.5
CHV2	37	11	15.8	31.2	0	6.9	2.41	5.49	0.51	0.03	47.8	34.5
CHV3	29	8	11	19	0.0	5.9	2.7	6.5	0.43	0.00	86	28
DEE1	45	10	11	39	0.7	6.4	2.2	5.3	0.26	0.13	0	18
EAG1	34	10	11	31	1.4	5.5	2.2	4.9	0.63	0.04	81	66
EAG3	42	14	25	27	0.0	4.4	2.5	6.0	0.11	0.00	76	21
EVD1	61	15	29.9	30.6	1.1	5.2	1.67	5.24	0.05	0.01	49.4	26.9
GRB1	65	21	16.1	21.1	1.1	2.6	2.56	4.7	1.53	0.03	23.2	25.0
HAI1	66	20	21	18	0.0	1.1	3.0	6.6	0.78	0.00	9	30
HSC1	52	11	20	37	0.0	3.4	2.1	6.0	0.31	0.00	22	33
KAN1	45	8	7.1	36.8	4.3	5.3	2.58	6.51	1.02	0.00	14.9	93.3
MAD1	51	10	10	51	1.3	4.3	2.9	5.8	0.00	0.00	6	43
NAN1	19	4	7.6	25.3	0.0	8.2	2.38	5.78	0.78	0.00	0.0	100.0
PIN1	46	13	19	23	0.7	6.6	2.0	5.0	0.07	0.15	37	34
RED1	51	12	14	22	0.0	6.5	2.4	5.9	0.18	0.07	10	9
ROY1	41	6	5.9	41.4	1.7	3.0	2.63	6.49	0.24	0.00	0.0	100.0
SAB1	37	10	22	39	0.0	7.3	1.8	5.3	0.09	0.08	0	31
SAL1	65	13	15	41	1.7	3.4	2.9	6.2	0.13	0.08	12	35
SPR1	50	9	18	39	0.0	2.7	2.7	5.6	0.18	0.00	36	35
SYH1	62	11	14	35	0.8	4.0	2.7	5.5	0.43	0.01	12	44
SYM1	43	7	14	32	1.3	7.0	2.0	5.8	0.01	0.00	51	44
SYS1	55	13	14	44	0.0	3.9	3.0	6.3	0.53	0.00	16	37
TAP1	28	8	9.4	38.9	0.0	6.9	2.17	5.65	0.13	0.01	30.1	64.8
TON1	65	13	29	29	1.9	6.0	2.3	6.8	0.16	0.00	68	34
VER1	50	14	27	16	0.0	4.5	2.0	5.2	5.17	0.00	40	34
WBV1	65	13	17	36	1.3	2.8	2.9	5.3	2.17	0.00	50	34
WCC3	62	14	22	36	2.3	3.2	2.8	5.2	0.95	0.00	40	29
MIN	19.0	4.0	5.7	15.6	0.0	0.0	1.6	4.7	0.0	0.0	0.0	0.0
MAX	68.0	21.0	29.9	58.0	4.3	8.7	3.0	7.1	5.2	0.2	88.7	100.0
AVG	48.1	11.0	16.3	34.6	0.7	4.6	2.4	5.8	0.7	0.0	32.5	39.7
STD	12.4	3.7	6.4	10.1	1.0	2.2	0.4	0.6	1.0	0.0	26.5	24.7

APPENDIX H CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND OF THIRTEEN METRIC SCORES COLLECTED FROM ARIZONA REFERENCE SITES IN 1992.

	METRICS TOT RICH	EPT RICH	EPT/CHI	%CHIRONOMID	%TANYTARSI	%SIMULIIDAE	DIVERSITY	HBI INDEX	SCRAPER/ COLLECTO	SHREDD RATIO	%HYDROPSYCHID TRICHOPTERA	%BAETIDAE/ EPHEMEROPTE
CLUSTER 2												
AGF1	55	12	20	33	1.4	2.7	1.9	6.7	0.20	0.01	34	36
ANT1	50	6	15	33	0.9	5.2	2.3	6.2	0.00	0.00	65	43
ARA1	59	10	26	47	0.3	3.5	2.5	5.3	0.39	0.00	45	28
BUR1	42	11	29	44	2.9	3.2	2.2	6.1	0.04	0.00	46	34
CGR1	72	22	32	28	2.0	2.2	3.3	6.4	0.32	0.03	18	28
CIE1	51	9	15	25	0.0	3.5	2.4	6.4	8.88	0.00	35	45
FRA1	59	15	31	32	2.1	1.9	3.0	5.9	0.41	0.00	46	25
HER1	45	10	9.1	28.9	3.6	3.9	2.33	6.44	0.49	0.00	25.4	100.0
LAC1	53	12	25	32	0.0	2.3	2.9	6.3	0.12	0.00	43	24
PEE1	63	14	30	28	0.0	1.4	2.8	6.6	0.69	0.00	18	24
ROU1	62	13	23	23	0.0	3.8	2.8	6.1	0.15	0.02	20	22
SCR1	51	9	18	16	1.0	2.7	2.2	7.3	7.80	0.00	26	35
SMR1	56	12	25	48	0.0	0.2	2.1	6.5	0.34	0.00	21	27
SPG1	62	17	32	26	0.0	1.5	0.9	6.7	0.87	0.00	28	23
SYD1	67	16	30	39	1.9	0.7	3.0	5.8	0.10	0.00	34	26
TRT1	64	11	27	43	0.4	1.7	2.3	6.2	0.60	0.00	39	25
MIN	42.0	6.0	9	16	0.0	0.2	0.9	5.3	0.0	0.0	18	22
MAX	72.0	22.0	32	48	3.6	5.2	3.3	7.3	8.9	0.0	65	100
AVG	56.9	12.4	24.1	32.9	1.0	2.5	2.4	6.3	1.3	0.0	33.9	34.0
STD	7.8	3.7	7	9	1.1	1.3	0.6	0.4	2.7	0.0	13	18

APPENDIX H CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND OF THIRTEEN METRIC SCORES COLLECTED FROM ARIZONA REFERENCE SITES IN 1992.

	METRICS											
CLUSTER 3	TOT RICH	EPT RICH	EPT/CHI	%CHIRONOMID	%TANYTARSI	%SIMULIIDAE	DIVERSITY	HBI INDEX	SCRAPER/ COLLECTO	SHREDD RATIO	%HYDROPSYCHID TRICHOPTERA	%BAETIDAE/ EPHEMEROPTE
BAR1	53	15	22.3	32.2	0.9	3.2	2.90	5.96	1.71	0.09	29.0	17.4
CKN1	63	19	18	38	0.0	3.5	3.1	5.1	1.23	0.15	8	32
CMB1	77	31	29	20	0.1	2.6	2.8	5.2	4.21	0.00	16	25
COL1	58	22	31	31	1.2	1.3	2.8	4.6	161.07	0.06	6	18
CYN1	62	19	25	27	0.0	1.2	2.7	4.9	9.26	0.00	19	25
ECL1	56	14	22	27	0.0	3.2	2.5	5.4	0.66	0.00	50	31
EFB1	63	12	19	28	0.0	4.2	2.4	4.9	1.50	1.50	0	29
ELC1	54	17	21	32	1.2	4.0	2.7	5.6	0.45	0.09	14	23
ETK1	64	19	23	31	0.0	3.4	3.0	4.7	0.58	0.22	9	30
FRY1	58	21	29	27	1.4	6.2	1.5	5.3	0.22	0.05	9	19
GRP1	55	13	16	31	3.5	8.0	1.2	5.6	0.04	0.04	0	29
HOR1	35	12	20	19	0.0	5.5	1.3	4.4	1.73	0.10	17	41
LAN1	80	21	27	35	1.6	2.7	2.9	5.4	0.36	0.36	11	29
LCR1	29	13	0.0	0.0	0.0	5.2	2.26	4.64	1.11	0.06	32.3	33.2
LIL1	46	10	10	20	1.5	3.2	2.6	5.3	1.20	0.33	42	39
MAM1	54	15	14	25	0.0	1.3	2.3	4.9	20.70	0.02	23	32
MAR1	52	15	16	33	1.8	6.1	1.6	5.5	0.16	0.16	10	24
MIN1	66	21	16	36	1.6	3.4	2.8	4.8	0.05	0.07	16	34
NBW1	43	21	23	24	0.0	3.1	2.9	4.8	2.52	0.11	14	25
OAK1	53	15	24	30	0.0	2.4	2.0	5.0	11.06	0.15	0	20
PAD1	45	12	19	26	1.0	3.3	2.4	4.3	12.58	0.02	27	35
RAM1	67	14	10	36	0.0	2.5	3.3	5.7	1.25	0.23	5	46
RES1	72	29	28	17	1.2	2.8	2.9	5.0	11.75	0.05	9	21
REY1	57	22	22	28	0.0	5.0	2.7	5.9	1.05	0.08	21	21
RUC1	52	12	9	50	3.0	5.9	2.8	5.3	0.20	0.07	0	49
RUD1	65	18	27	30	1.1	2.1	2.8	4.9	16.13	0.04	11	25
SFC1	61	15	17	47	2.8	5.5	2.8	5.0	0.13	0.13	0	29
SLC1	51	19	35	16	0.0	5.5	2.0	5.2	0.46	0.06	24	20
WAR1	72	17	16	41	0.6	4.0	3.0	5.4	0.32	0.06	0	34
WCC1	56	18	38	23	0.0	3.6	2.8	6.0	2.46	0.03	5	18
WEB1	57	13	33	40	0.5	4.9	2.7	5.9	0.34	0.01	49	18
WFB1	73	26	29	28	1.7	1.5	2.9	4.9	10.86	10.86	16	27
WFO1	64	20	28	33	1.5	1.6	2.4	6.1	3.62	0.00	10	19
WLC1	40	17	27	18	0.0	8.2	1.3	5.3	0.09	0.03	17	26
WLC2	38	13	14	17	0.0	6.9	2.1	5.1	0.17	0.32	0	42
WOR1	56	16	19	36	1.1	2.0	3.0	4.9	4.59	0.30	14	24
MIN	29.0	10.0	0.0	0.0	0.0	1.2	1.2	4.3	0.0	0.0	0.0	17.4
MAX	80.0	31.0	37.7	49.6	3.5	8.2	3.3	6.1	161.1	10.9	49.8	48.7
MEAN	56.9	17.4	21.5	28.6	0.8	3.9	2.5	5.2	7.9	0.4	14.8	28.0
STD	11.3	4.7	7.8	9.3	0.9	1.8	0.5	0.5	26.4	1.8	12.9	8.0

APPENDIX H. CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND THIRTEEN METRIC SCORES AT ARIZONA REFERENCE SITES IN 1992.

	% ABUNDANCE OF TOP 5 DOMINANTS	MOST DOMINANT 5 TAXA				
CLUSTER 1						
ARA2	56	BAETIDE	SERRATL	SIMULII	LOPESCL	RHITHRG
ASH1	66	SIPHLON	DYTISCD	LAUTERB	ZAVRLMY	OSTRAC
BAR2	58	LEPTOPH	BAETIDE	CERTPG	STEMPEL	POLYPED
BAS1	85	TRICORY	BAETIDE	CHORTH	ACARIII	CERTPG
BLC1	82	SIMULII	EUKIEFF	CAPNIID	TELOPOK	NEOHER
BLU1	68	MICYLEP	BAETIDE	ISOPERL	SIMULII	HYDROP
BLU4	76	BAETIDE	ACARIII	SIMULII	CHORTH	HYDROP
BRA1	70	BAETIDE	SIMULII	MICYLEP	HELICOP	EUKIEFF
CDO1	93	BAETIDE	SIMULII	DYTISCD	ORTHCL1	CERTPG
CGN1	49	CAENISS	SIMULII	EUKIEFF	CERTPG	CHORTH
CHE1	73	BAETIDE	CHORTH	CHEUMA	POLYPED	HYDROP
CHE2	58	BAETIDE	SIMULII	CHEUMA	HYDROP	POLYPED
CHV2	73	LEPTOPH	BAETIDE	SIMULII	HEPTAG	ORCONE
CHV3	72	ORCONE	HEPTAG	BAETIDE	LEPTOPH	CHEUMA
DEE1	71	SIMULII	TAENIOP	OLIGOCH	AMELETS	BRILLIA
EAG1	52	HYDROP	BAETIDE	ACARIII	POLYPED	CHEUMA
EAG3	69	TRAVERL	LEPTHYP	HYDROP	BAETIDE	PSEPHEN
EVD1	93	SIMULII	BAETIDE	COENAG	TRICORY	EUKIEFF
GRB1	56	HYDROP	EPEORUS	BAETIDE	GLOSSO	TRICORY
HAI1	64	CERTPG	OECETIS	BAETIDE	MICYLEP	LEPTOPH
HSC1	79	CHORTH	BAETIDE	TRICORY	OLIGOCH	NILOTAN
KAN1	88	BAETIDE	NEOTRIC	CHIRNMS	SIMULII	ACARIII
MAD1	69	PHYLLOI	CAENISS	SIMULII	CONTHIE	DYTISCD
NAN1	60	BAETIDE	SIMULII	CRICOTP	ACARIII	CERTPG
PIN1	85	BAETIDE	SIMULII	CAENISS	ACARIII	CERTPG
RED1	53	CHORTH	SIMULII	HEXATO	ORTHCLE	CONTHIE
ROY1	61	BAETIDE	OCHROT	OSTRAC	CRICOTP	EUKIEFF
SAB1	82	BAETIDE	SIMULII	EUKIEFF	CAENISS	CORYNO
SAL1	72	PHYSELL	EUKIEFF	CAENISS	APEDILU	SIMULII
SPR1	68	BAETIDE	HYDROP	TRICORY	POLYPED	EUKIEFF
SYH1	59	BAETIDE	SIMULII	TRICORY	OCHROT	EUKIEFF
SYM1	88	TRICORY	SIMULII	BAETIDE	ACARIII	CRICOTP
SYS1	55	ORTHCL1	SIMULII	ORTHCLE	BAETIDE	ACARIII
TAP1	74	BAETIDE	SIMULII	ORTHCLE	ORTHCL1	CRICOTP
TON1	95	SIMULII	CERTPG	BAETIDE	LEPTHYP	ORTHCLE
VER1	87	BAETIDE	SERRATL	MAYATRI	TRICORY	MICYLEP
WBV1	59	BAETIDE	ACARIII	ORTHCL1	MICYLEP	NEOCYLL
WCC3	63	BAETIDE	ACARIII	MICYLEP	SERRATL	SIMULII
	70					

APPENDIX H. CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND THIRTEEN METRIC SCORES AT ARIZONA REFERENCE SITES IN 1992.

	% ABUNDANCE OF TOP 5 DOMINANTS	MOST DOMINANT 5 TAXA				
CLUSTER 2						
AGF1	80	TRICORY	CERTPG	CRICOTP	BAETIDE	CHEUMA
ANT1	71	SIMULII	BAETIDE	CERTPG	PHYSELL	CRICOTP
ARA1	68	BAETIDE	CRICOTP	ORTHCL1	SERRATL	SIMULII
BUR1	79	TRICORY	BAETIDE	CERTPG	OCHROT	CHEUMA
CGR1	47	CAENISS	POLYPED	CHORTH	BAETIDE	STICTOC
CIE1	60	MICYLEP	BAETIDE	PHYSELL	PLANORB	CRICOTP
FRA1	53	TRICORY	BAETIDE	LEPTONM	NECTOC	MICYLEP
HER1	70	OSTRAC	BAETIDE	ARGIAAA	LIBELLU	MICYLEP
LAC1	59	TRICORY	HYDROP	CERTPG	POLYPED	CHEUMA
PEE1	57	TRICORY	BAETIDE	HEXATO	CERTPG	CHORTH
ROU1	57	TRICORY	SIMULII	DYTISCD	CHORTH	CORIXID
SCR1	73	CORIXID	FOSSARI	TRICORY	PHYSELL	OSTRAC
SMR1	71	LEPTHYP	BAETIDE	ACARIII	POLYPED	CHORTH
SPG1	59	TRICORY	CERTPG	BAETIDE	ACARIII	CHORTH
SYD1	64	CHEUMA	BAETIDE	TRICORY	CERTPG	STICTOC
TRT1	75	TRICORY	BAETIDE	ACARIII	CHORTH	CERTPG
	65					

APPENDIX H. CLUSTER SUMMARY OF PERCENT COMPOSITION BY INSECT ORDERS AND THIRTEEN METRIC SCORES AT ARIZONA REFERENCE SITES IN 1992.

	% ABUNDANCE OF TOP 5 DOMINANTS	MOST DOMINANT 5 TAXA				
CLUSTER 3						
BAR1	54	CAENISS	TRICORY	AMPHINM	HEPTAG	SIMULII
CKN1	53	SIMULII	CONTHIE	AMPHINM	EUKIEFF	BAETIDE
CMB1	62	BAETIDE	OPTIOSR	ACARIII	MICYLEP	HELICOP
COL1	68	ZAITZEV	OPTIOSR	CONSTM	EPEORUS	PARALEP
CYN1	68	BAETIDE	HEPTAG	ACARIII	CAENISS	OPTIOSR
ECL1	70	BAETIDE	DUBIRPH	CAENISS	MICYLEP	HYDROP
EFB1	82	BRACHY	SIMULII	ACARIII	BAETIDE	EPHEME
ELC1	69	EUKIEFF	SIMULII	OPTIOSR	AMPHINM	PAGASTI
ETK1	66	BAETIDE	SIMULII	CRICNOS	AMPHINM	LEPSAND
FRY1	83	SIMULII	EPEORUS	BAETIDE	CINYGML	AMELETS
GRP1	89	SIMULII	BAETIDE	AMPHINM	CINYGML	AMELETS
HOR1	80	BAETIDE	AMPHINM	SIMULII	CINYGML	ACARIII
LAN1	64	BAETIDE	CERTPG	SIMULII	CAENISS	STEMPEL
LCR1	72	BAETIDE	OPTIOSR	HYDROP	AMPHINM	SIMULII
LIL1	65	AMPHINM	OLIGOCH	HYDSCN	BAETIDE	HYDROP
MAM1	74	OPTIOSR	OSTRAC	CINYGML	BAETIDE	CHLRPER
MAR1	80	SIMULII	LEPTURR	EPEORUS	CINYGML	PERICOM
MIN1	63	OPTIOSR	CRICNOS	BAETIDE	SIMULII	PARALEP
NBW1	42	CONSTM	BAETIDE	ACARIII	OPTIOSR	EPEORUS
OAK1	64	TRICORY	CAENISS	OPTIOSR	ACARIII	BAETIDE
PAD1	75	BAETIDE	OPTIOSR	CONSTM	CINYGML	EPEORUS
RAM1	52	AMPHINM	EUKIEFF	OCHROT	CRICOTP	DIAMESA
RES1	59	OPTIOSR	HEPTAG	BAETIDE	LAUTERB	ZAITZEV
REY1	50	SIMULII	CAENISS	EUKIEFF	GUMAGA	BAETIDE
RUC1	63	BAETIDE	SIMULII	CONTHIE	MICROPS	STEMPEL
RUD1	64	BAETIDE	OPTIOSR	PARALEP	ZAITZEV	HEPTAG
SFC1	67	SIMULII	BAETIDE	OLIGOCH	CHORTH	STEMPEL
SLC1	82	SIMULII	HEPTAG	BAETIDE	AMPHINM	ZAITZEV
WAR1	53	SIMULII	BAETIDE	HEXATO	ORTHCL1	CONTHIE
WCC1	63	BAETIDE	CAENISS	CHORTH	LEPTHYP	SIMULII
WEB1	62	SIMULII	BAETIDE	CHORTH	EUKIEFF	CAENISS
WFB1	62	BAETIDE	LAUTERB	HEPTAG	OPTIOSR	ACARIII
WFO1	73	CAENISS	ACARIII	GUMAGA	PISIDUM	TRICORY
WLC1	91	SIMULII	BAETIDE	ACARIII	EPEORUS	AMPHINM
WLC2	85	LEPSAND	SIMULII	ACARIII	PISIDUM	BAETIDE
WOR1	59	AMPHINM	ZAITZEV	ZAVRLMY	PRTENDP	PARALEP
	67					

APPENDIX I.

Percent composition of the macroinvertebrate community by insect orders and by functional feeding groups at Arizona reference sites sampled in 1992.
(I1-I3)

Appendix I. Percent composition of the macroinvertebrate community by insect orders and by functional feeding groups at Arizona reference sites sample in 1992.

RIFFLE SAMPLES	Total Animals	TAXONOMIC GROUPS (PERCENT)								FUNCTIONAL FEEDING GROUPS (PERCENT)						COMMUNITY PARAMETERS									
		Non-Insects	Odonata	Ephem.	Plec.	Trich.	Other Insects	Coleop.	Diptera	CF	CG	PA	PR	SC	SH	Richness Total	Richness EPT	EPT/ Chiron.	Percent Chiron.	Percent Simul.	HBI	Diversity Indices Sh/Wv	Diversity Indices Marg.	Diversity Indices Simp.	Even.
LITTLE COLORADO BASIN																									
Barbershop Canyon (Lower)	1428	5.3	0.0	41.0	0.8	1.5	0.0	0.4	50.8	30.8	60.5	0.8	5.0	1.7	1.2	19	5	2.4	18.3	30.8	5.0	2.2	2.5	0.71	0.51
Barbershop Canyon (Upper)	4566	4.6	1.1	48.5	7.2	8.1	3.3	3.2	24.1	9.8	58.2	1.9	11.0	6.2	12.8	28	14	4.7	13.6	4.9	5.4	3.6	3.2	0.86	0.75
Chevelon Canyon (Long Tom)	956	3.6	0.2	37.9	3.8	2.3	0.0	4.0	48.3	30.5	53.8	0.2	4.8	6.9	3.8	17	7	2.2	19.7	28.7	5.0	2.6	2.3	0.76	0.63
Chevelon Canyon (Telephone Ridge)	102	12.7	0.0	12.7	0.0	28.4	4.9	10.8	30.4	43.1	26.6	2.9	8.2	13.7	5.3	14	5	5.3	7.8	16.7	5.0	3.2	2.8	0.86	0.85
East Clear Cr. (Kinder Crossing)	7240	1.9	0.0	55.5	0.1	13.1	1.8	10.9	16.7	19.3	74.0	0.4	4.6	1.1	0.5	20	7	7.2	9.5	6.4	4.4	2.3	2.1	0.66	0.53
East Clear Cr. (Macks Crossing)	2172	3.1	0.2	21.2	0.0	25.8	0.9	8.1	40.7	32.2	57.8	0.7	8.6	0.4	0.2	18	6	1.3	35.5	4.6	4.9	2.5	2.2	0.77	0.60
East Fk Little Colorado R.	5752	2.4	0.0	6.4	6.8	8.9	0.0	10.0	65.5	31.0	47.2	1.3	9.8	2.9	7.9	26	14	0.6	38.8	24.8	5.0	2.8	2.9	0.77	0.60
Lily Cr.	611	13.4	0.0	12.1	40.8	10.5	0.0	9.8	13.4	10.6	23.7	1.8	11.5	10.2	42.1	21	9	16.1	3.9	2.3	3.8	3.3	3.1	0.82	0.75
Little Colorado R. (Mouth)	11	9.1	0.0	27.3	0.0	0.0	0.0	0.0	63.6	36.4	50.9	0.0	12.7	0.0	0.0	0	0	0.0	18.2	36.4	5.4	0.0	0.0	0.00	0.00
Little Colorado R. (abv S. Fk.)	3208	1.5	0.0	43.1	11.0	14.5	3.5	11.2	15.2	14.0	58.4	1.2	11.5	8.5	6.4	21	9	8.9	7.7	5.2	4.0	3.2	2.5	0.82	0.73
Little Colorado R. (blw Nutrioso)	4720	1.5	0.0	70.7	0.0	16.4	0.3	0.7	10.3	11.9	78.8	0.3	1.9	6.9	0.2	16	6	10.9	8.0	2.2	4.2	1.8	1.8	0.53	0.46
Little Colorado R. (blw S. Fk.)	1752	2.5	0.0	44.7	9.8	7.5	0.7	9.6	25.1	19.4	59.7	2.5	11.7	4.8	1.9	18	10	6.8	9.1	14.6	4.3	2.8	2.3	0.78	0.68
Mamie Cr.	782	17.6	0.0	18.9	3.8	5.4	0.0	45.0	9.2	3.3	73.8	1.8	7.7	10.7	2.8	19	8	4.8	5.9	0.0	4.6	2.9	2.7	0.76	0.67
Mineral Cr.	2974	7.0	0.1	14.8	4.7	4.6	0.4	28.4	40.1	13.3	65.0	3.4	8.8	2.1	7.4	25	10	0.9	26.2	10.2	4.8	3.1	3.0	0.82	0.67
Paddy Cr.	1506	7.0	0.0	37.8	4.6	2.5	0.0	28.2	19.8	3.1	71.4	6.1	8.8	8.9	1.7	18	8	2.8	16.2	2.0	4.5	2.8	2.3	0.80	0.66
Rudd Cr.	3616	4.6	0.0	41.8	4.2	6.0	0.9	32.5	10.0	1.5	73.1	4.0	8.4	9.0	4.0	25	11	7.6	6.9	0.7	4.0	3.1	2.9	0.81	0.68
S. Fk. Little Colorado R.	9544	1.8	0.0	28.1	7.3	3.4	0.5	7.4	51.6	52.4	24.7	1.3	2.5	12.7	6.5	22	11	57.9	0.7	49.9	4.9	2.6	2.3	0.71	0.57
West Fk. Little Colorado R. (Lower)	3408	17.1	0.0	12.9	4.9	23.5	0.0	6.3	35.2	34.0	19.1	14.8	2.9	1.9	27.3	16	8	29.3	1.4	31.9	4.5	2.8	1.8	0.80	0.69
West Fk. Little Colorado R. (Upper)	8928	3.2	0.0	17.7	2.7	1.5	0.0	1.0	73.8	72.8	14.8	3.1	1.7	5.1	2.5	15	9	15.3	1.4	72.4	5.5	1.6	1.5	0.46	0.41
UPPER GILA BASIN																									
Blue R. (Lower)	808	7.7	0.0	48.8	0.0	4.2	1.5	4.5	33.4	29.2	58.7	7.7	3.4	0.7	0.3	14	6	7.1	7.4	25.2	4.9	2.4	1.9	0.72	0.63
Blue R. (Upper)	1820	4.2	0.0	31.2	7.9	9.5	0.9	32.7	13.6	11.0	68.7	4.0	11.4	4.8	0.1	20	7	11.1	4.4	4.8	4.2	2.9	2.5	0.79	0.66
Campbell Blue R.	4008	5.5	0.4	36.7	0.7	17.4	1.6	21.0	16.8	7.7	68.2	5.3	6.2	8.3	4.3	33	18	5.7	9.6	3.8	4.4	3.4	3.9	0.83	0.67
Coleman Cr.	5232	2.3	0.2	32.3	6.1	4.0	0.0	42.8	12.4	0.3	64.5	1.8	6.0	22.0	5.4	22	13	3.6	11.8	0.2	4.0	2.7	2.5	0.76	0.61
Eagle Cr. (Honeymoon)	1268	19.2	0.0	32.8	0.0	29.5	0.5	0.5	17.5	31.7	45.6	18.5	3.6	0.5	0.2	19	6	4.4	14.0	2.5	5.0	2.4	2.5	0.76	0.56
Eagle Cr. (Sheep Wash)	838	5.3	0.0	52.6	0.0	22.2	1.0	3.6	15.3	25.8	61.3	5.0	3.0	4.3	0.5	20	9	7.0	10.8	3.8	3.9	3.0	2.8	0.83	0.69
East Turkey Cr.	3316	2.5	1.6	19.8	10.1	16.8	0.0	7.5	41.7	20.1	38.6	0.7	10.8	4.7	25.0	27	13	3.7	12.5	19.4	4.3	3.5	3.2	0.88	0.73
Frye Cr.	5820	0.0	0.3	17.6	0.1	1.4	0.1	0.1	80.4	75.9	5.7	0.0	2.2	15.9	0.2	21	11	6.6	2.9	75.8	5.5	1.3	2.3	0.40	0.30
Grant Cr. (Blue)	399	2.8	0.3	36.6	2.5	41.4	0.5	2.0	14.0	33.3	20.9	2.8	11.8	30.6	0.6	23	11	16.1	5.0	2.3	4.0	3.2	3.7	0.83	0.71
Grant Cr. (Pinaleno)	2840	1.7	0.0	7.9	2.5	1.5	0.0	0.1	86.2	80.7	10.0	0.1	2.2	3.1	3.8	18	11	3.3	3.7	80.7	5.7	1.4	2.1	0.34	0.32
Lanphler Canyon	4792	2.8	1.0	38.2	1.7	3.3	0.2	0.5	52.3	7.8	58.1	1.2	27.7	3.0	2.2	24	10	2.0	21.2	7.5	5.1	3.0	2.7	0.80	0.65
Marijilda Cr.	4640	1.0	0.2	11.0	0.2	1.6	0.0	0.7	85.3	81.9	4.5	0.3	1.7	11.0	0.5	22	11	7.4	1.7	81.6	5.6	1.2	2.5	0.33	0.27
San Francisco R.	4760	0.7	0.3	71.4	0.0	3.5	0.8	1.5	21.8	15.3	78.6	0.7	3.2	2.2	0.0	16	7	7.9	9.5	12.0	3.7	2.6	1.8	0.79	0.66
South Fk Cave Cr.	684	8.2	0.0	15.2	0.9	1.8	1.8	0.6	71.6	49.4	37.6	0.9	7.7	2.9	1.5	19	11	0.8	21.1	49.4	5.4	2.4	2.8	0.70	0.56
UPPER SALT BASIN																									
Conklin Cr.	3696	1.3	0.6	14.3	16.5	3.7	0.4	17.3	45.9	20.6	43.9	1.3	11.0	7.8	15.5	25	14	1.5	23.4	20.3	4.5	3.2	2.9	0.85	0.69
East Fork Black R.	3200	4.0	0.3	17.0	1.0	38.0	0.3	2.8	36.8	66.0	24.9	3.0	3.5	1.0	1.6	20	7	9.0	6.3	28.0	3.6	2.6	2.4	0.76	0.60
Horton Cr.	4992	2.7	0.0	76.8	10.7	1.0	0.0	2.2	6.6	4.6	76.2	2.4	2.1	4.1	10.6	18	9	61.3	1.4	4.5	4.0	1.7	2.0	0.47	0.41
N. Fk. Bear Wallow Cr.	1672	5.5	0.0	44.0	7.7	9.6	0.0	11.5	21.8	10.3	54.6	5.3	7.2	14.4	8.3	22	14	4.3	14.1	4.5	4.4	3.3	2.8	0.85	0.74
Reservation Cr.	1740	5.2	0.0	27.0	3.4	11.5	0.8	33.2	18.9	6.2	55.0	4.0	6.7	23.6	4.5	31	15	4.2	10.0	3.8	4.2	3.4	4.0	0.85	0.69
West Fork Black R.	2864	6.6	0.0	42.9	3.4	7.0	1.8	9.8	28.6	3.9	61.6	5.6	9.3	15.6	4.0	31	17	2.1	25.3	0.6	4.6	3.2	3.8	0.83	0.65

Appendix I. Percent composition of the macroinvertebrate community by insect orders and by functional feeding groups at Arizona reference sites sample in 1992.

RIFFLE SAMPLES	Total Animals	TAXONOMIC GROUPS (PERCENT)								FUNCTIONAL FEEDING GROUPS (PERCENT)						COMMUNITY PARAMETERS									
		Non-Insects	Odonata	Ephem.	Plec.	Trich.	Other Insects	Coleop.	Diptera	CF	CG	PA	PR	SC	SH	Richness Total	Richness EPT	EPT/ Chiron.	Percent Chiron.	Percent Simul.	HBI	Diversity Indices Sh/Wv	Diversity Indices Marg.	Diversity Indices Simp.	Even.
MIDDLE SALT BASIN																									
Campaign Cr.	1702	2.4	1.6	20.1	0.0	11.5	0.7	10.0	53.7	24.3	52.3	1.5	15.7	5.1	1.0	30	10	1.4	23.1	16.7	5.2	3.7	3.9	0.89	0.76
Canyon Cr.	3652	6.8	0.0	60.4	0.0	3.6	1.5	12.2	15.6	1.8	63.3	5.4	5.9	22.4	1.3	27	13	4.6	14.0	0.3	4.6	2.7	3.2	0.77	0.57
Cherry Cr. (Lower)	2532	6.2	0.2	32.1	0.0	16.1	0.8	0.6	44.1	28.3	56.6	4.4	10.3	0.2	0.3	19	6	1.8	26.9	12.3	4.9	2.9	2.3	0.69	0.69
Cherry Cr. (Upper)	2660	3.9	0.0	59.5	0.0	17.6	0.2	0.2	18.6	16.4	73.2	3.6	4.8	2.0	0.1	18	6	4.7	16.4	0.2	4.4	2.1	2.2	0.65	0.51
Deer Cr.	1576	7.6	0.3	2.8	17.8	0.5	2.0	0.0	69.0	57.9	16.1	1.8	5.9	18.0	0.3	14	5	2.2	9.4	57.9	5.1	2.0	1.8	0.62	0.53
Greenback Cr.	8488	0.6	0.8	31.1	0.0	19.2	0.8	1.7	45.7	35.2	49.4	0.6	7.6	7.0	0.2	22	7	2.6	19.4	23.1	5.0	2.8	2.3	0.81	0.63
Haigler Cr.	1604	2.0	1.0	25.9	0.0	33.2	1.0	23.2	13.7	28.7	55.5	1.2	7.0	4.2	3.3	27	11	8.2	7.2	2.0	4.2	3.2	3.5	0.83	0.67
Reynolds Cr.	1816	1.3	0.4	15.1	2.8	7.2	0.4	1.0	71.8	49.0	34.6	1.2	10.8	2.6	1.8	29	13	1.0	24.8	43.4	5.4	2.7	3.7	0.73	0.55
Salome Cr.	8576	2.0	0.0	19.1	0.0	1.5	0.7	2.5	74.3	21.5	64.6	0.5	11.7	1.6	0.2	23	7	0.4	52.8	20.9	5.6	1.9	2.4	0.64	0.43
Spring Cr.	8928	1.6	0.1	70.8	0.0	7.3	1.8	3.1	15.2	6.7	76.3	1.5	11.8	3.0	0.7	29	10	16.8	4.7	0.5	4.1	2.9	3.1	0.77	0.60
Tonto Cr. (Gisela)	4320	2.0	0.1	28.0	0.2	6.2	0.5	1.7	61.4	53.8	38.2	1.9	4.9	0.8	0.5	25	10	3.0	11.4	48.1	5.3	2.5	2.9	0.72	0.53
Workman Cr.	3230	7.1	0.8	18.6	40.8	6.3	0.0	13.3	13.3	7.3	33.2	1.2	9.9	10.1	38.3	28	14	6.7	9.7	0.8	3.4	3.3	3.3	0.82	0.68
SAN PEDRO/WILLCOX BASINS																									
Aravalpa Canyon (Lower)	1020	2.5	0.4	53.9	0.0	5.7	0.4	8.4	28.8	15.1	65.6	2.5	5.7	10.4	0.8	18	8	3.5	16.9	10.2	4.2	3.2	2.5	0.86	0.76
Aravalpa Canyon (Upper)	10520	3.4	0.1	27.8	0.0	1.4	0.0	1.4	65.8	4.4	76.5	3.1	15.7	0.2	0.0	18	7	0.5	58.6	3.2	5.2	2.1	1.8	0.61	0.50
Bass Canyon	7188	2.7	0.2	81.4	0.0	2.6	0.1	1.3	11.7	1.9	89.3	2.4	4.6	0.9	0.7	22	9	11.9	7.1	1.4	4.2	2.1	2.4	0.61	0.48
Goudy Cr.	3720	1.9	0.0	0.8	0.0	0.1	0.1	0.1	97.0	94.5	3.5	0.0	0.9	1.0	0.1	13	4	0.7	1.3	94.5	5.9	0.5	1.5	0.11	0.12
Hot Springs Canyon	2780	4.2	0.9	76.3	0.0	2.2	0.1	0.1	16.3	2.6	87.2	1.4	7.1	1.0	0.7	22	7	8.4	9.4	1.9	3.6	2.6	2.7	0.76	0.59
Ramsey Canyon	2204	4.9	4.0	3.6	21.6	15.6	0.0	3.1	47.2	5.3	37.7	1.1	17.2	14.9	23.8	33	12	1.2	35.0	5.1	4.7	3.3	4.2	0.82	0.66
Redfield Canyon	894	2.2	1.8	36.2	0.0	2.9	1.3	3.4	52.1	33.3	50.9	0.4	13.4	0.0	1.9	23	8	2.9	13.6	31.5	4.5	2.8	3.2	0.77	0.61
San Pedro R.	2508	6.4	0.3	46.4	0.0	19.5	0.3	3.8	23.3	19.3	68.0	1.9	6.3	4.1	0.3	18	5	3.6	18.5	2.6	4.5	2.7	2.2	0.77	0.65
Ward Canyon	1454	1.9	1.7	19.5	5.0	5.4	0.1	2.8	63.7	27.5	42.3	1.8	14.6	5.2	8.6	31	14	1.1	26.7	27.4	5.2	3.1	4.1	0.82	0.62
SANTA CRUZ BASIN																									
Canada del Oro Cr.	7008	0.9	0.0	42.7	0.0	0.7	0.5	1.6	53.7	45.0	50.0	0.7	4.3	0.0	0.0	9	2	4.9	8.9	44.3	5.1	1.6	0.9	0.61	0.52
Cave Cr.	1004	0.6	0.0	0.0	0.4	0.0	0.6	0.0	98.4	84.1	11.7	0.2	3.6	0.0	0.4	7	1	0.0	14.1	84.1	5.9	0.8	0.9	0.27	0.27
Cienega Cr.	3644	18.4	1.1	23.3	0.0	7.7	0.8	40.0	8.8	4.3	71.7	1.3	2.5	19.3	0.9	21	6	5.1	6.0	2.6	4.9	2.7	2.4	0.77	0.62
Gardner Cr.	841	3.1	0.0	0.5	0.2	0.0	1.3	0.5	94.4	71.1	21.5	0.5	6.7	0.0	0.3	14	3	0.0	22.9	71.1	5.9	1.2	1.9	0.44	0.32
Madera Cr.	766	6.8	0.0	5.5	0.1	1.4	1.0	0.7	84.5	32.5	48.2	5.1	13.3	0.5	0.3	17	7	0.1	50.9	32.1	5.9	1.9	2.4	0.63	0.47
Sabino Cr.	3840	0.0	0.0	47.9	0.0	0.2	0.0	0.0	51.9	48.5	49.9	0.0	1.3	0.2	0.0	8	4	19.2	2.5	48.5	5.0	1.3	0.9	0.54	0.43
Santa Cruz R.	10224	41.4	1.6	30.0	0.0	1.2	13.8	6.5	5.6	1.3	38.8	0.4	20.9	34.3	4.4	25	4	49.8	0.6	0.7	6.1	2.8	2.6	0.79	0.61
RIO DE MEXICO BASINS																									
Rucker Cr.	276	6.5	0.4	34.1	6.9	2.9	0.4	0.4	48.6	26.8	51.8	0.7	8.8	4.7	7.1	20	10	2.2	19.9	26.8	4.9	2.8	3.4	0.80	0.65
Sycamore Cr. (Sonora)	1472	9.2	5.8	16.0	0.0	4.6	0.3	3.3	60.7	23.9	44.5	3.4	23.8	3.8	0.5	24	7	0.7	28.7	23.5	5.8	3.1	3.2	0.83	0.68

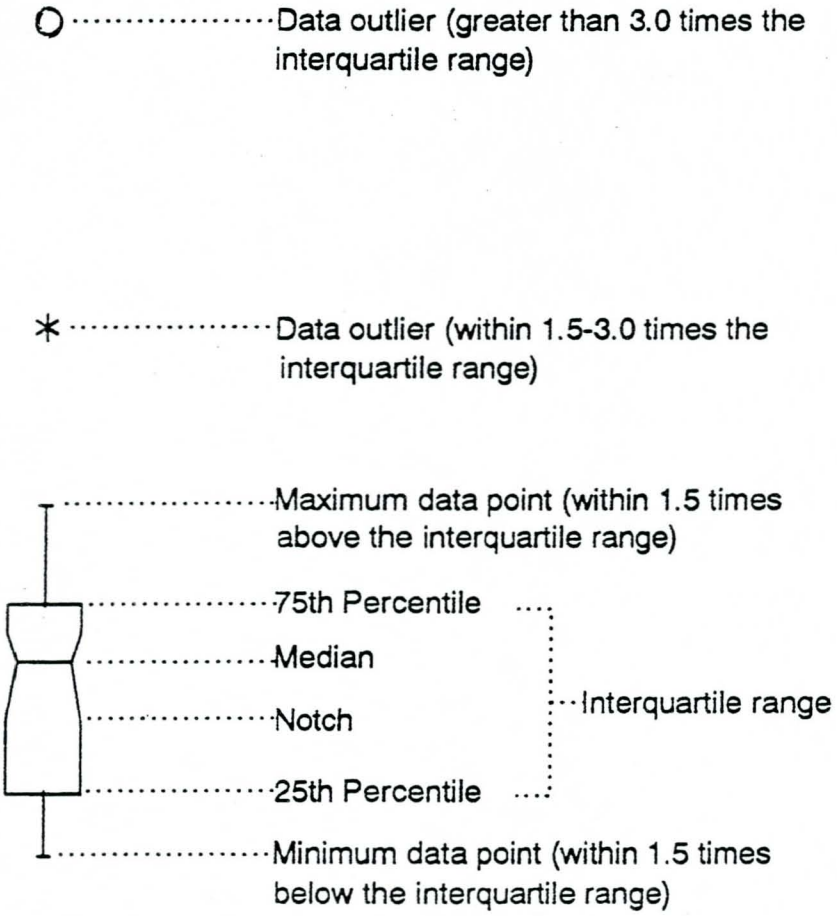
Appendix I. Percent composition of the macroinvertebrate community by insect orders and by functional feeding groups at Arizona reference sites sample in 1992.

RIFFLE SAMPLES	Total Animals	TAXONOMIC GROUPS (PERCENT)								FUNCTIONAL FEEDING GROUPS (PERCENT)						COMMUNITY PARAMETERS									
		Non-Insects	Odonata	Ephem.	Plec.	Trich.	Other Insects	Coleop.	Diptera	CF	CG	PA	PR	SC	SH	Richness Total	Richness EPT	EPT/ Chiron.	Percent Chiron.	Percent Simul.	HBI	Diversity Indices Sh/Wv	Diversity Indices Marg.	Diversity Indices Simp.	Even.
VERDE BASIN																									
Black Canyon	1732	1.0	0.0	0.7	7.5	0.0	2.1	0.3	88.3	61.3	21.4	0.7	9.1	1.4	6.1	13	3	0.3	24.8	61.3	5.5	1.7	1.6	0.56	0.45
East Verde R. (Brushy Canyon)	2096	3.2	0.2	17.4	0.6	0.8	0.2	26.7	51.0	36.1	56.8	2.1	3.5	0.8	0.8	15	5	1.3	14.7	35.9	5.1	2.3	1.8	0.75	0.58
East Verde R. (Ellison)	16616	0.3	0.2	40.9	0.3	0.6	0.0	1.9	55.8	51.4	45.5	0.0	1.7	0.8	0.5	22	7	9.1	4.6	50.7	5.1	1.6	2.2	0.58	0.36
Oak Cr. (Pine Flat)	1485	6.2	0.3	45.4	0.0	5.5	0.0	36.0	6.6	2.2	79.6	5.8	2.6	9.1	0.7	27	10	14.3	3.6	2.2	4.4	2.5	3.6	0.73	0.53
Pine Cr.	1736	5.8	0.2	56.2	1.8	1.8	0.9	0.5	32.7	29.5	60.0	5.5	4.3	0.5	0.2	18	9	14.4	4.1	27.9	4.8	2.1	2.3	0.64	0.51
Roundtree Cr.	3368	2.1	2.5	23.9	0.0	5.1	0.5	7.2	58.7	46.8	39.5	2.0	8.5	2.6	0.6	28	9	2.9	10.1	43.3	5.1	3.0	3.3	0.77	0.62
Sycamore Cr. (Horseshoe)	1604	4.5	2.4	41.5	0.0	9.9	0.1	8.2	33.4	16.8	64.8	1.9	8.8	7.7	0.0	25	9	3.1	16.7	13.3	4.9	3.1	3.3	0.80	0.66
Sycamore Cr. (Mazatzal)	2886	6.1	0.0	33.4	0.0	3.5	0.1	0.5	56.4	51.9	40.2	5.1	2.3	0.3	0.1	20	4	5.4	6.8	48.8	5.4	2.1	2.4	0.66	0.48
Verde R. (Perkinsville)	3780	3.5	0.0	58.5	0.1	25.0	0.3	9.3	3.3	7.9	67.7	3.3	1.0	20.0	0.1	20	8	158.0	0.5	2.2	3.6	2.6	2.3	0.77	0.60
Webber Cr.	5080	0.5	0.0	33.1	0.1	1.7	0.6	2.4	61.7	34.6	48.8	0.5	7.7	8.1	0.3	24	9	1.3	26.9	33.5	5.2	2.8	2.7	0.78	0.60
West Clear Cr. (Lower)	2808	11.7	0.1	46.9	0.1	1.6	1.6	13.5	24.5	11.3	71.2	9.5	4.7	2.3	1.0	22	6	3.6	13.7	9.7	4.5	3.1	2.6	0.84	0.68
West Clear Cr. (Upper)	6744	5.2	0.1	48.0	4.6	11.6	0.4	11.7	18.3	13.3	56.8	4.4	4.3	16.1	5.1	23	9	12.0	5.3	12.3	4.4	3.4	2.5	0.88	0.75
West Fork Oak Cr.	4200	6.5	0.2	31.4	0.2	8.4	1.3	9.7	42.3	5.5	70.3	5.3	11.7	3.4	3.7	25	12	1.1	37.7	1.7	5.2	3.0	2.9	0.79	0.65
Wet Beaver Cr.	1720	16.3	0.0	45.8	0.0	4.2	2.3	14.7	16.7	10.7	67.5	12.6	4.9	3.7	0.6	21	7	6.1	8.1	6.7	4.9	2.8	2.7	0.77	0.66
MIDDLE GILA BASIN																									
Agua Fria R.	15616	6.4	0.4	41.4	0.4	13.1	0.4	3.3	34.6	21.5	61.3	4.1	8.2	4.1	0.9	26	6	2.7	20.7	10.7	5.0	2.7	2.6	0.76	0.58
Antelope Cr.	6424	2.2	0.0	18.3	0.0	9.3	0.2	0.4	69.5	70.1	22.1	0.7	2.3	4.6	0.1	14	3	7.7	3.6	63.9	5.5	1.8	1.5	0.55	0.47
Hassayampa R. (Upper)	816	0.2	0.0	0.2	0.7	72.3	0.0	0.7	25.7	10.3	12.5	0.0	4.2	72.3	0.7	9	3	5.0	14.7	10.3	4.5	1.3	1.2	0.44	0.41
Lion Canyon	1924	0.3	0.0	0.4	0.0	0.0	0.1	3.1	96.1	2.0	56.8	0.3	40.9	0.0	0.0	11	1	0.0	62.3	2.0	6.0	1.6	1.3	0.54	0.45
Little Ash Cr.	9392	2.7	1.2	28.8	0.0	29.6	0.7	0.9	36.1	27.8	47.1	1.5	20.0	3.6	0.0	26	8	3.6	16.0	1.4	4.9	3.4	2.7	0.86	0.71
Poland Cr.	2968	14.3	0.0	0.3	0.0	0.3	0.5	3.8	80.9	62.5	13.6	10.8	8.7	3.5	0.8	13	2	0.0	16.7	62.3	6.2	1.8	1.5	0.57	0.49
Sycamore Cr. (Dugas)	21568	1.3	0.1	37.5	0.0	26.3	0.2	1.6	33.1	23.3	60.4	1.1	11.7	3.0	0.5	27	11	3.7	17.1	0.1	4.8	3.0	2.6	0.83	0.64
BILL WILLIAMS BASIN																									
Burro Cr.	9504	1.5	0.0	45.0	0.0	31.9	0.0	0.4	21.1	21.5	51.7	1.5	10.8	14.4	0.0	12	6	9.8	7.8	4.0	4.4	2.8	1.2	0.82	0.79
Conger Cr.	5612	2.6	3.4	19.5	0.0	23.2	0.2	3.3	47.8	22.7	56.0	0.7	13.9	6.6	0.2	30	10	1.2	36.1	7.4	5.0	3.4	3.4	0.83	0.68
Francis Cr.	16608	1.0	0.2	38.9	0.4	29.3	1.5	9.1	19.7	29.3	61.3	0.6	6.7	2.1	0.0	21	8	4.4	15.6	1.5	4.4	3.0	2.1	0.83	0.67
Peeples Canyon	1392	2.7	5.7	43.4	0.0	15.9	0.4	2.3	29.5	17.1	63.1	2.7	13.5	2.3	1.3	27	8	4.6	12.9	4.5	4.7	3.6	3.6	0.87	0.75
Santa Maria R.	5440	3.1	0.1	69.4	0.0	8.6	2.1	0.5	16.3	3.0	81.1	2.9	6.6	5.7	0.7	24	8	5.7	13.7	0.1	4.3	2.5	2.7	0.72	0.54
Trout Cr.	4172	1.1	0.1	65.9	0.0	16.7	0.1	5.9	10.3	16.7	77.2	1.1	2.7	0.7	1.6	15	6	9.4	8.8	0.7	4.2	2.6	1.7	0.77	0.66
NORTHERN COLORADO MAINSTEM																									
Bright Angel Cr.	2776	1.9	0.1	29.0	0.0	8.4	0.4	20.5	39.8	27.5	61.3	1.4	3.1	6.3	0.3	13	4	2.6	14.3	25.5	4.8	2.5	1.5	0.79	0.67
Havasu Cr.	472	2.3	0.2	83.5	0.0	10.2	0.0	0.2	3.6	11.0	86.4	0.0	2.4	0.2	0.0	10	3	63.1	1.5	1.1	4.2	1.0	1.5	0.29	0.30
Hermit Cr.	3456	29.7	17.8	15.6	0.0	6.1	1.2	7.2	22.3	8.6	65.4	0.2	25.0	0.7	0.1	21	5	2.0	10.9	3.4	6.5	3.2	2.5	0.85	0.73
Kanab Cr.	355	6.2	2.3	36.6	0.0	26.2	2.3	0.3	26.2	18.0	43.8	5.4	8.2	23.9	0.6	17	4	8.0	7.9	16.6	4.8	2.6	2.7	0.64	0.64
Matkatamiba Cr.	574	1.6	3.0	46.7	0.0	9.6	2.1	0.5	36.6	5.9	67.1	1.6	21.1	3.3	1.0	16	4	4.3	13.2	5.9	5.0	2.8	2.4	0.76	0.71
Nankoweap Cr.	293	7.8	7.5	33.8	0.0	4.4	0.3	4.1	42.0	13.7	53.0	7.8	21.0	4.4	0.0	11	2	2.1	18.1	13.7	5.5	2.8	1.8	0.81	0.81
Paria R.	42	0.0	0.0	14.3	0.0	83.3	0.0	0.0	2.4	83.3	16.2	0.0	0.5	0.0	0.0	3	2	41.0	2.4	0.0	4.0	0.8	0.3	0.54	0.47
Royal Arch Cr.	1304	16.4	0.8	8.9	0.0	20.9	0.5	1.2	51.4	2.9	52.1	1.5	13.4	30.1	0.0	19	5	0.8	37.3	2.5	5.7	2.9	2.5	0.79	0.68
Spring Canyon	6248	39.6	7.0	9.2	0.0	16.9	2.4	0.4	24.5	10.5	63.6	0.3	18.1	7.0	0.4	19	3	1.5	17.2	0.6	6.4	2.8	2.1	0.79	0.66
Tapeats Cr.	1102	1.3	0.0	35.6	2.0	3.6	0.0	0.5	57.0	21.6	62.3	0.5	11.3	2.2	2.1	19	8	1.2	33.4	19.8	5.1	2.4	2.6	0.74	0.56

APPENDIX J.

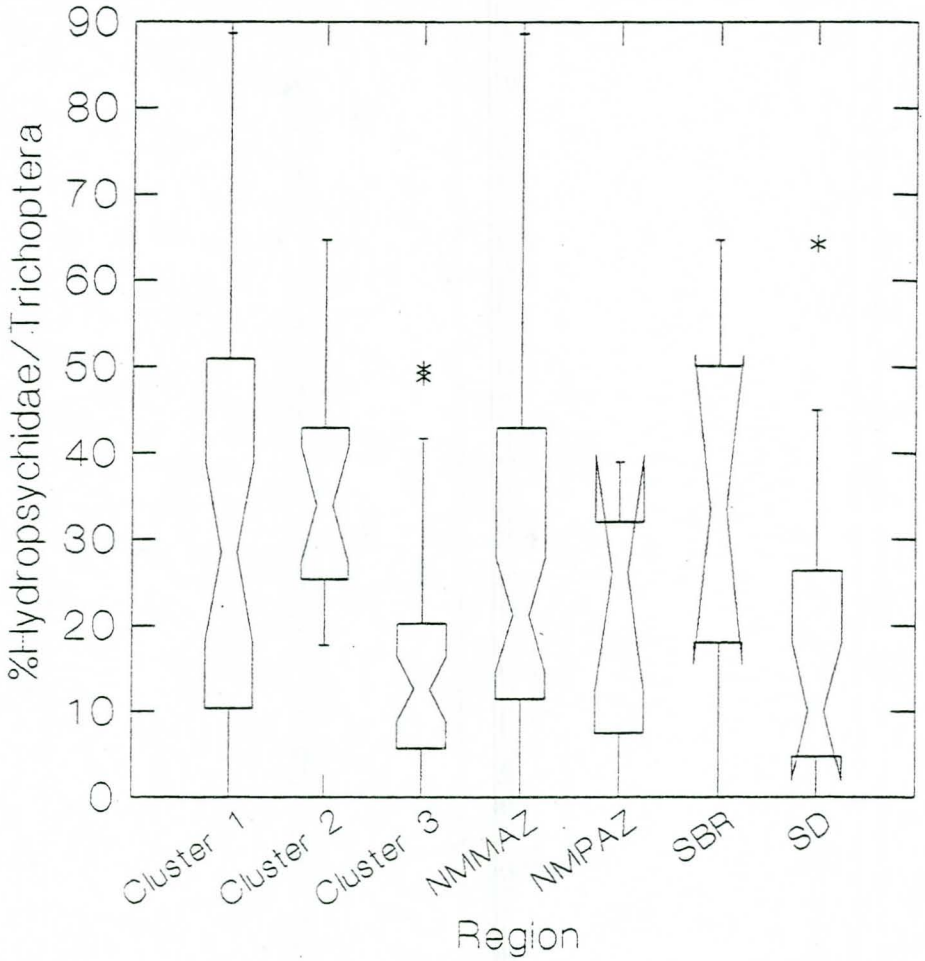
Comparison of box and whisker plots for each of the thirteen metrics by cluster number and ecoregion; a summary of macroinvertebrate data collected at Arizona reference sites in 1992.
(J1-J14)

Box Plot Example



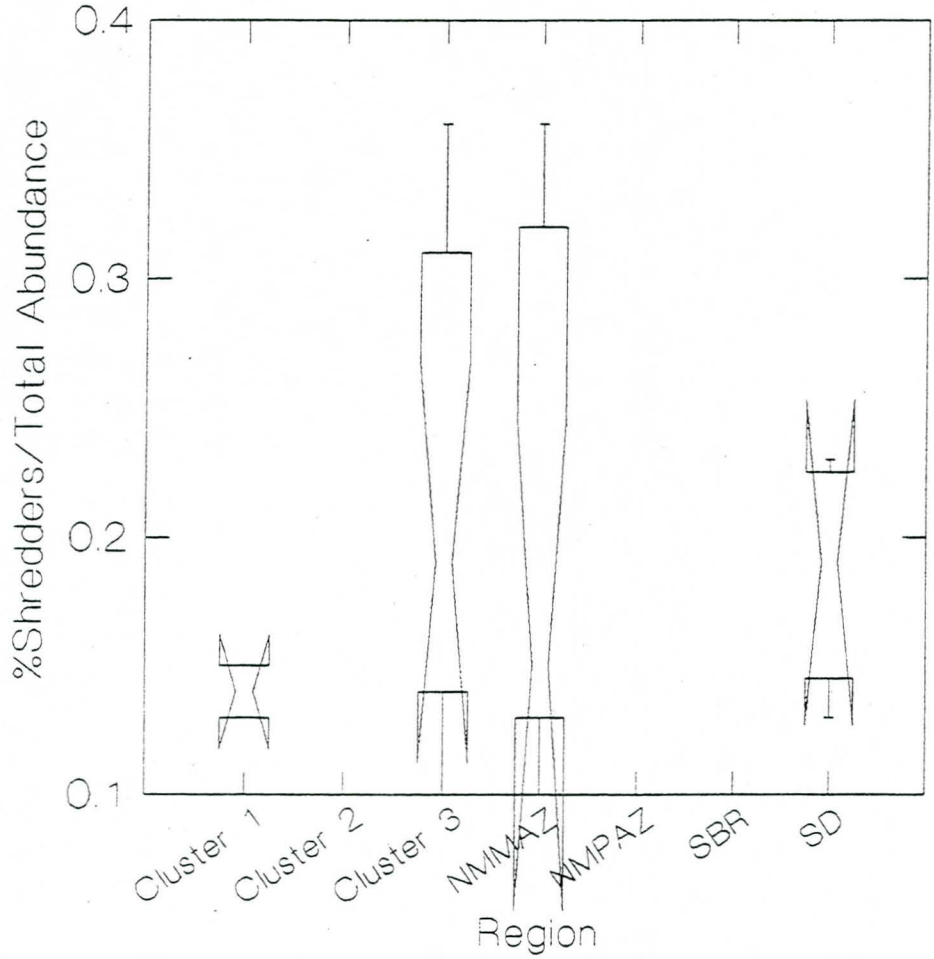
(notches in the box indicate 95% confidence intervals about the median)

Percent Hydropsychidae/Trichoptera

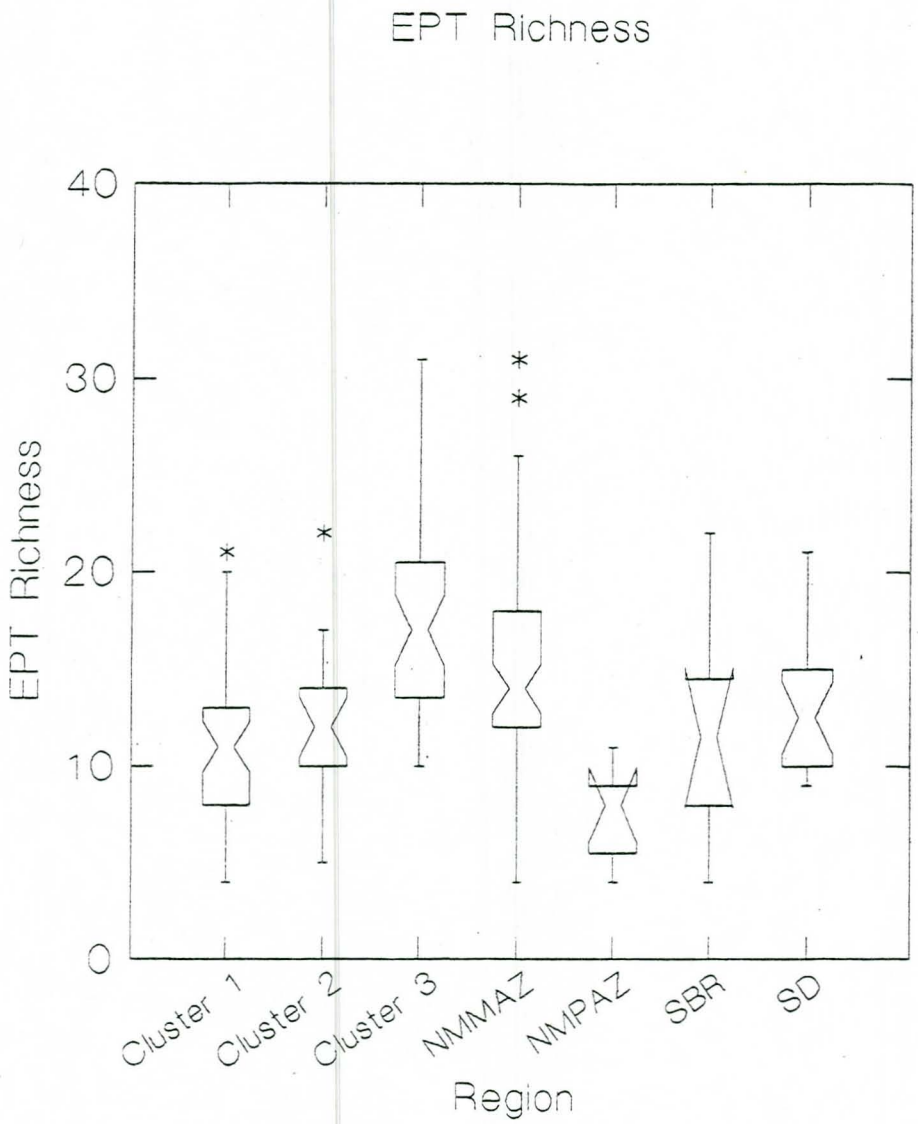


NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts

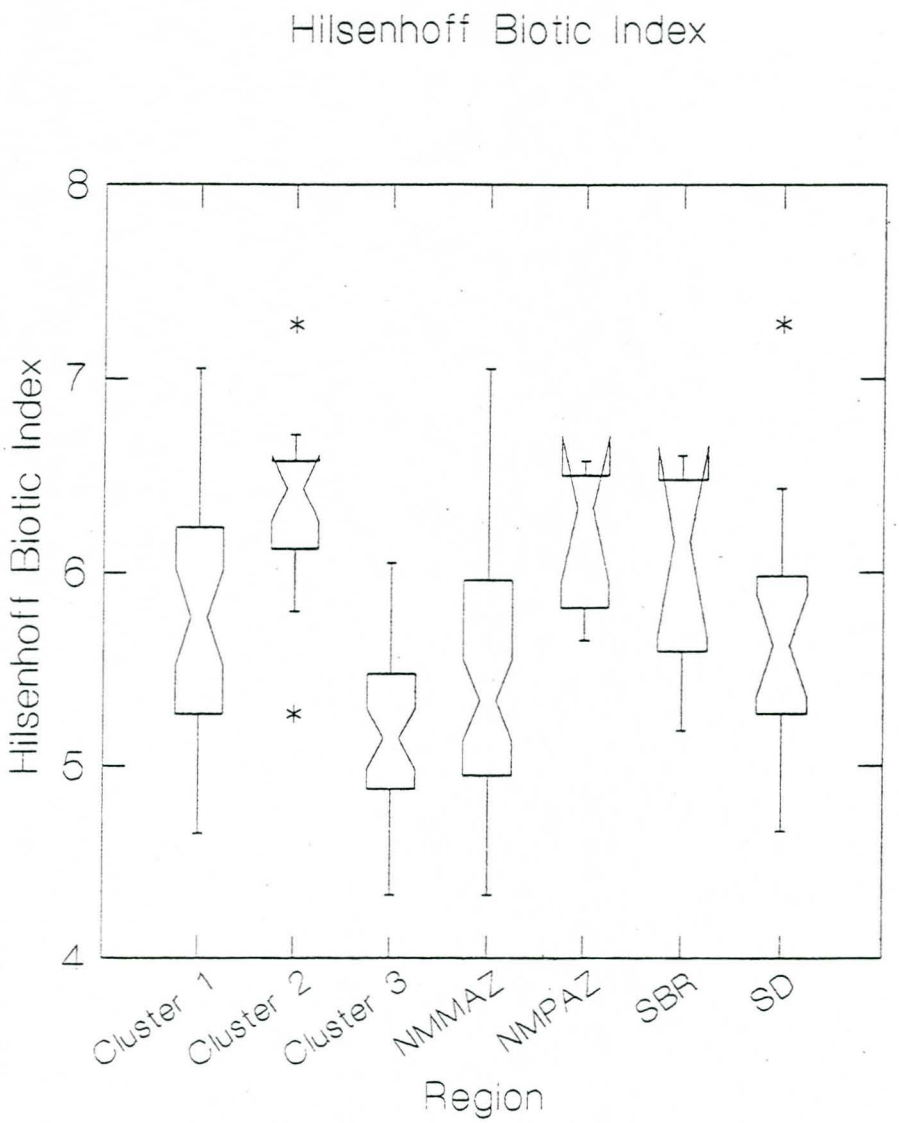
Percent Shredders



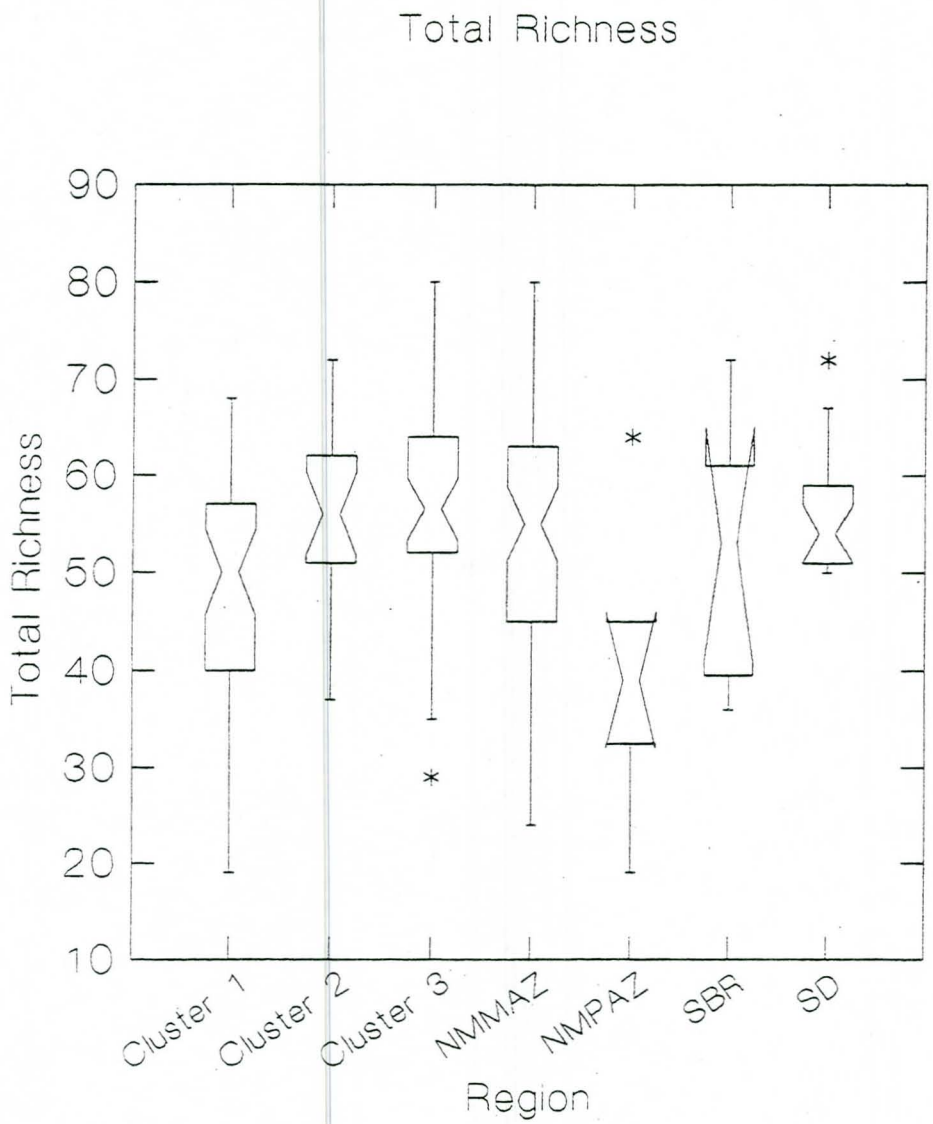
NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts



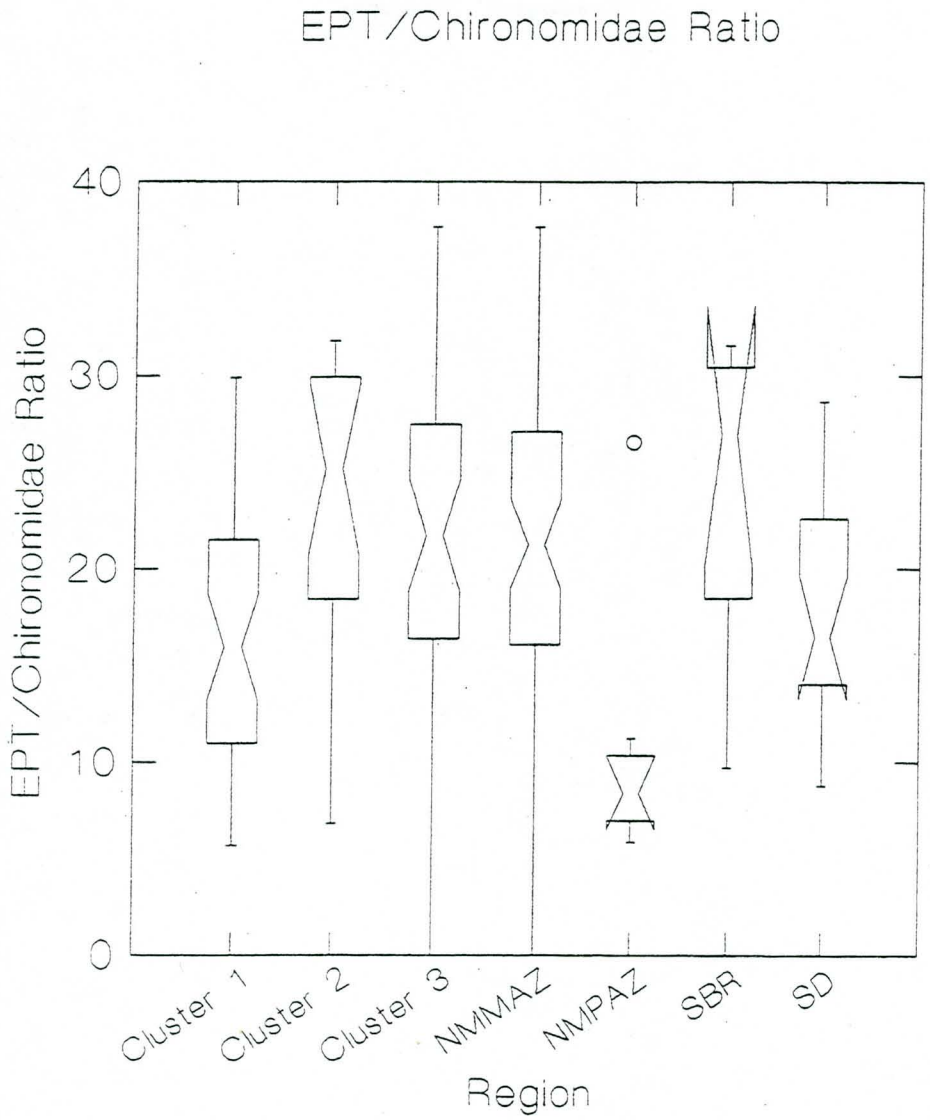
NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts



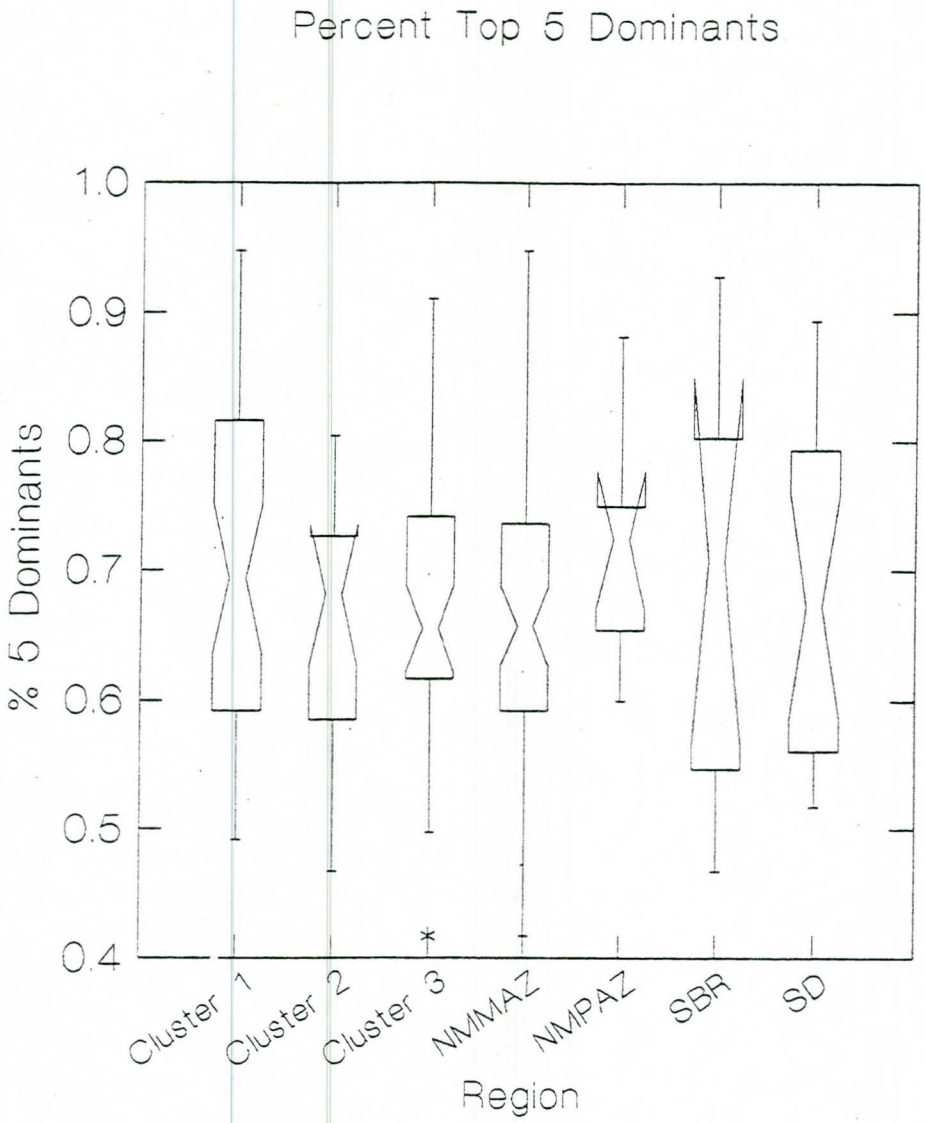
NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts



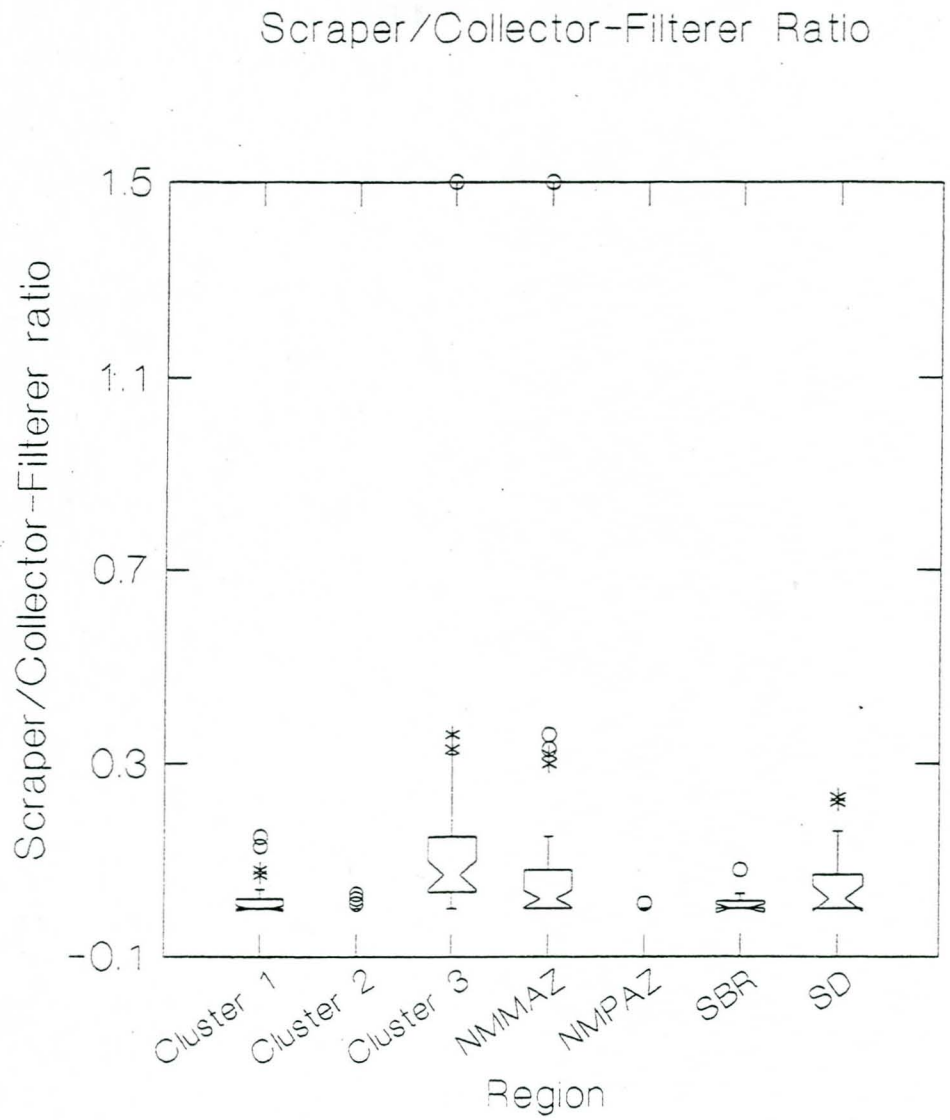
NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts



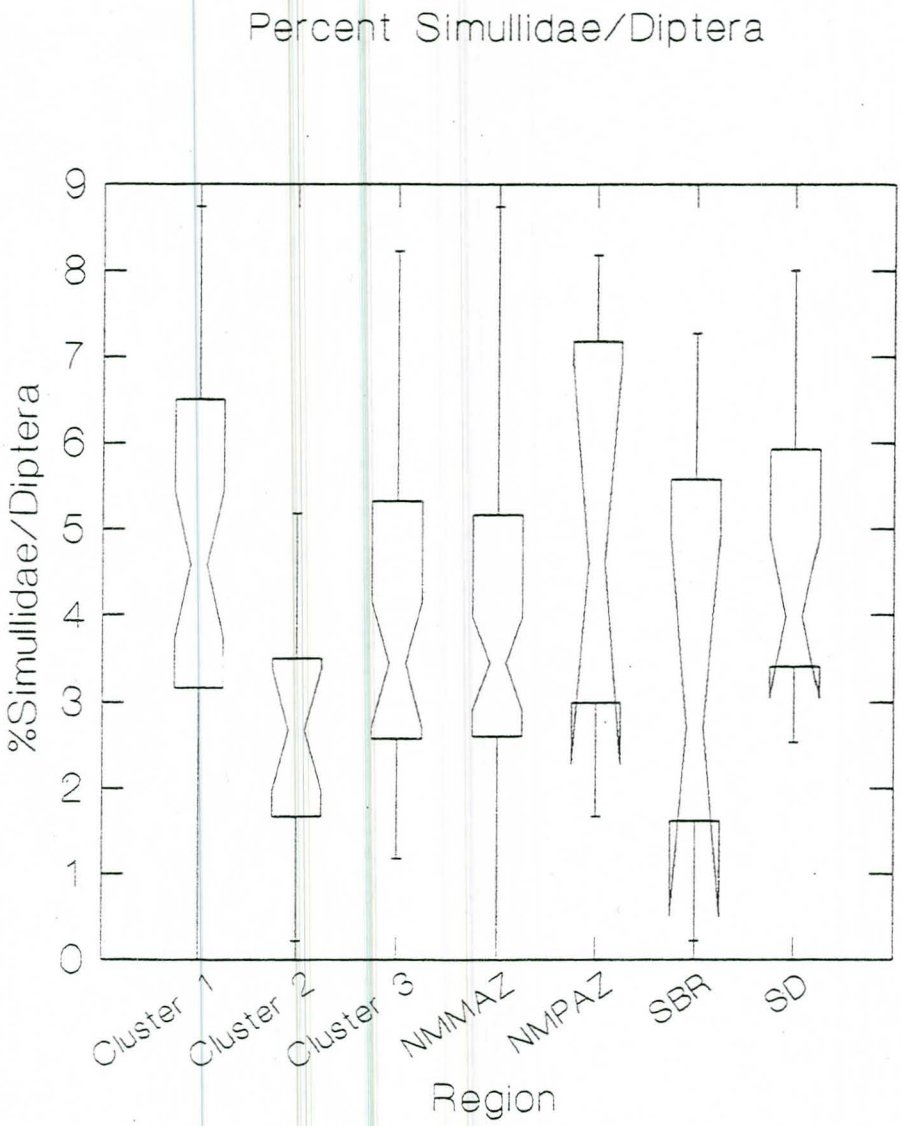
NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts



NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts

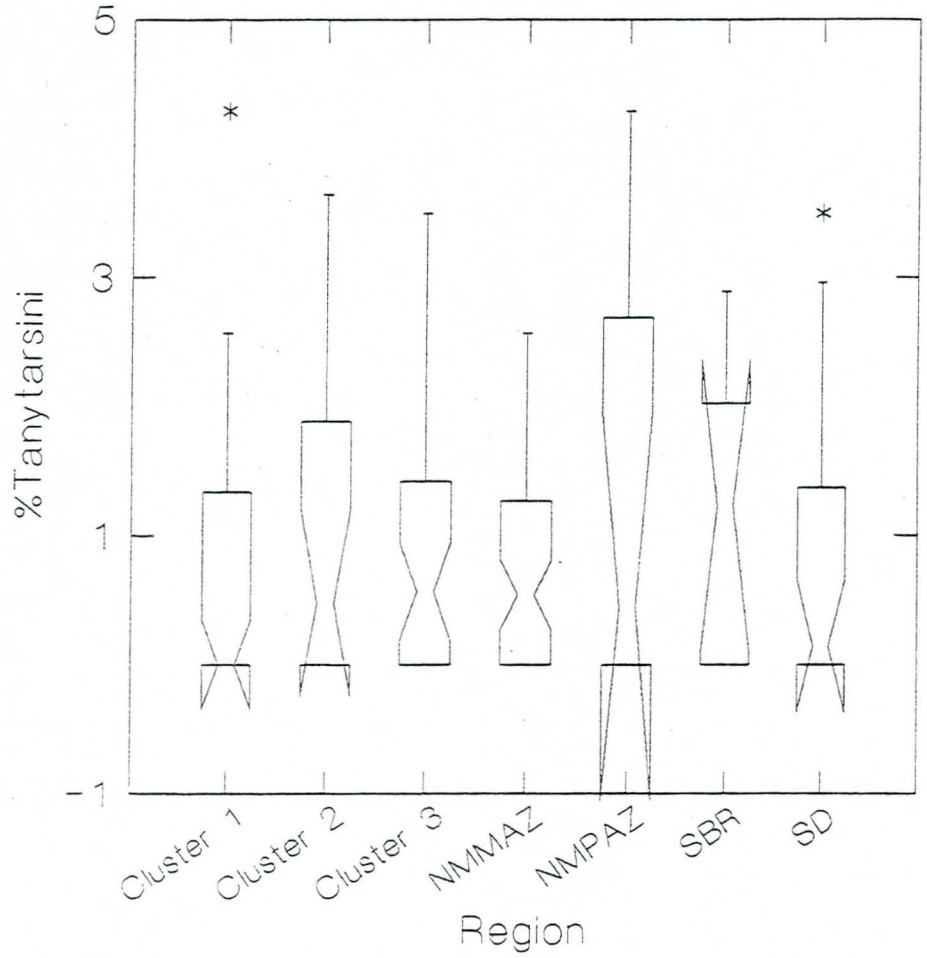


NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts

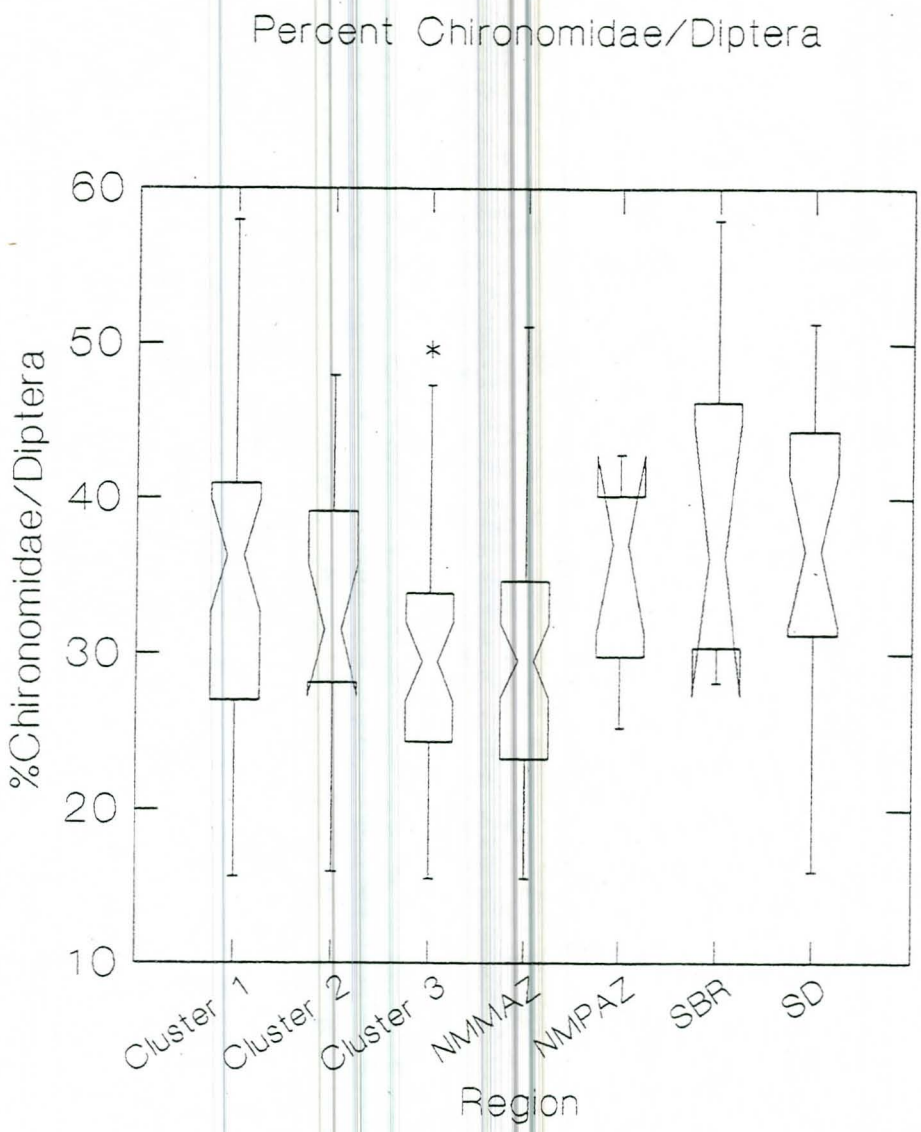


NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts

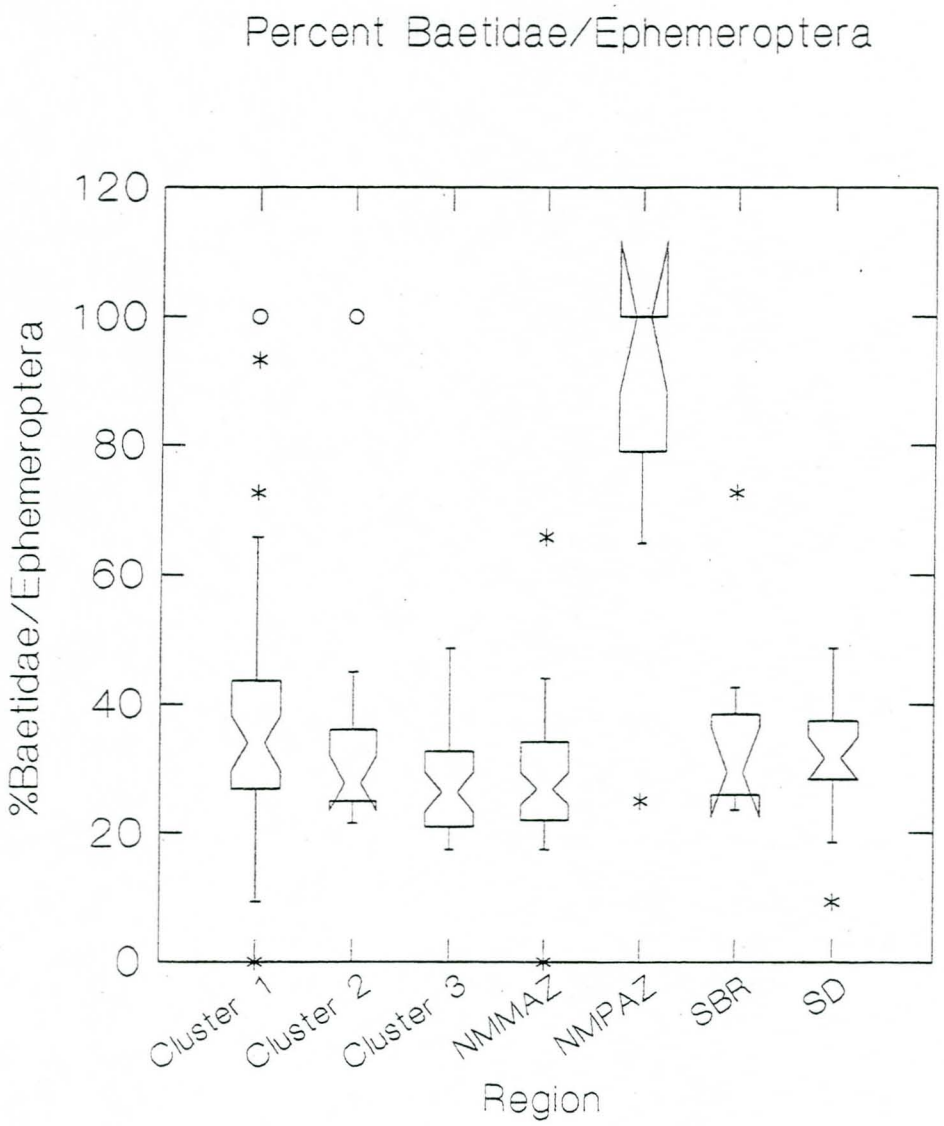
Percent Tanytarsini



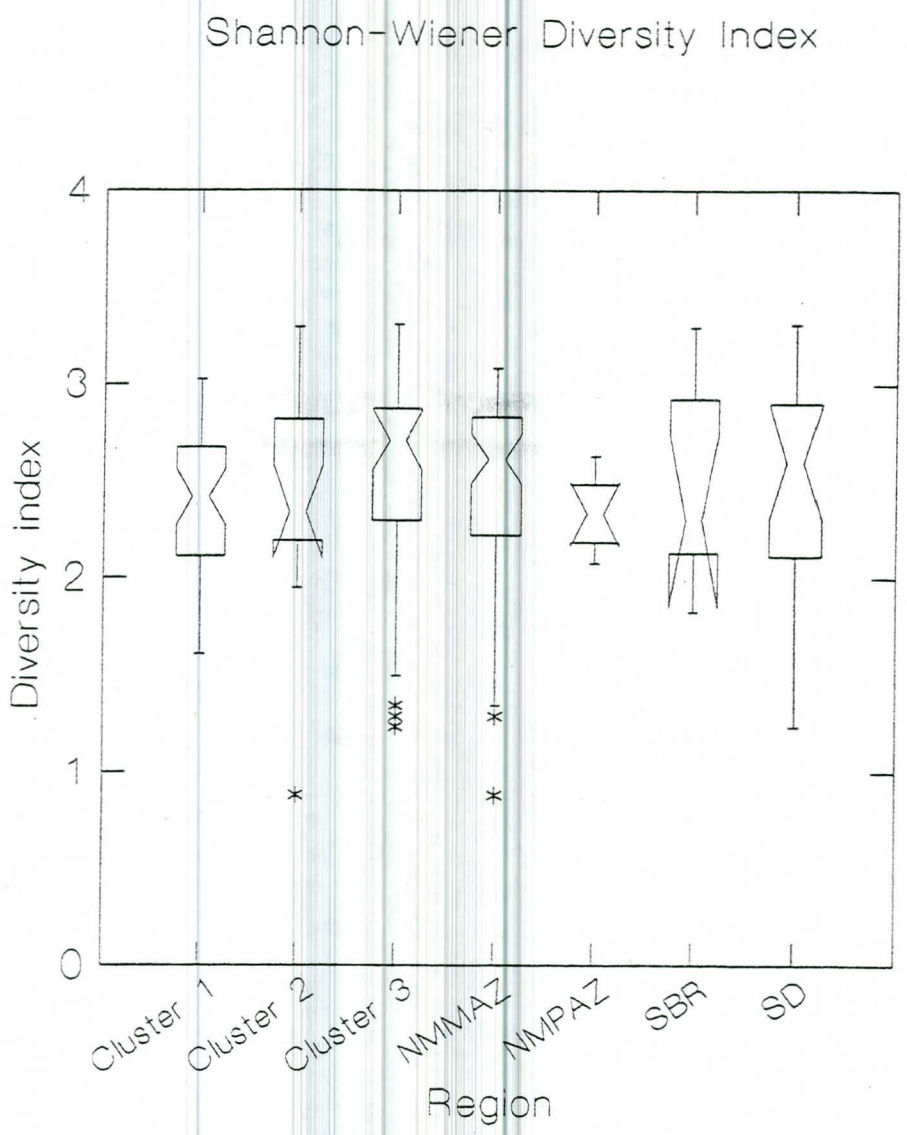
NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts



NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts



NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts



NMMAZ	Arizona-New Mexico Mountains
NMPAZ	Arizona-New Mexico Plateau
SBR	Southern Basin and Range
SD	Southern Deserts