



Long Term Resource Monitoring Program Procedures:
Macroinvertebrate Monitoring



*The Upper Midwest Environmental Sciences Center issues LTRMP Program Reports
to provide Long Term Resource Monitoring Program partners
with programmatic documentation, procedures manuals, and annual status reports.*

**Upper Midwest Environmental
Sciences Center**

PROGRAM MANAGER
Robert L. Delaney

ACTING MONITORING SCIENCES
AND COORDINATION MANAGER
Kenneth S. Lubinski

CHIEF, SUPPORT SERVICES
Barbara A. Deml

REPORT EDITOR
Jerry D. Cox

Cover graphic by Mi Ae Lipe-Butterbrodt

Mention of trade names or commercial products does not constitute endorsement
or recommendation for use by the U.S. Department of the Interior, U.S. Geological Survey.

Long Term Resource Monitoring Program Procedures: Macroinvertebrate Monitoring

by

Pamella A. Thiel
U.S. Fish and Wildlife Service
La Crosse Fishery Resource Office
555 Lester Avenue
Onalaska, Wisconsin 54650

and

Jennifer S. Sauer
U.S. Geological Survey
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Revised May 1999

U.S. Geological Survey
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Suggested citation:

Thiel, P. A., and J. S. Sauer. 1999. Long Term Resource Monitoring Program Procedures: Macroinvertebrate monitoring. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, Revised May 1999. LTRMP 95-P002-2 (Revised 1999). 7 pp. + Appendixes A-H

Contents

	<i>Page</i>
Preface	v
1. Monitoring Rationale for Macroinvertebrates	1
1.1 Specific Sampling Methods for Target Taxa	1
1.1.1 Choosing Sample Size and Locations	1
1.2 Laboratory Protocol	6
2. References	7
Appendix A. References Used to Choose Historical (Fixed) Sample Sites	A-1
Appendix B. Long Term Resource Monitoring Program Macroinvertebrate Collection Sheet	B-1
Appendix C. Field Materials	C-1
Appendix D. Figures of Target Taxa	D-1
Appendix E. Long Term Resource Monitoring Program Macroinvertebrate Log Sheet	E-1
Appendix F. Laboratory Materials	F-1
Appendix G. Long Term Resource Monitoring Program Macroinvertebrate Laboratory Sheet	G-1
Appendix H. Changes Made to Long Term Resource Monitoring Program Macroinvertebrate Procedures since 1992	H-1

Tables

Table 1. Macroinvertebrate random sample sites by study reach and aquatic area	2
Table 2. Sampling period time frames	3

Figure

Figure. Labels for macroinvertebrate samples	5
--	---

Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' Environmental Management Program. The LTRMP is being implemented by the Upper Midwest Environmental Sciences Center (UMESC), a U.S. Geological Survey science center, in cooperation with the five Upper Mississippi River System (UMRS) States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The U.S. Army Corps of Engineers provides guidance and has overall Program responsibility. The mode of operation and respective roles of the agencies are outlined in a 1988 Memorandum of Agreement.

The UMRS encompasses the commercially navigable reaches of the Upper Mississippi River, as well as the Illinois River and navigable portions of the Kaskaskia, Black, St. Croix, and Minnesota Rivers. Congress has declared the UMRS to be both a nationally significant ecosystem and a nationally significant commercial navigation system. The mission of the LTRMP is to provide decision makers with information to maintain the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and impacts, develop management alternatives, manage information, and develop useful products.

This report is a procedures manual for field station personnel under the direction of the UMESC and conducting monitoring of macroinvertebrates for the LTRMP. The report partially satisfies Task 2.2.7, *Monitor and Evaluate Selected Macroinvertebrate Populations and Communities* under Goal 2, *Monitor Resource Change* of the Operating Plan (U.S. Fish and Wildlife 1993). The purpose of the report is to provide standard procedures for the collection and preparation of samples of macroinvertebrates collected from the field stations for 1999 and following years. This report was developed with funding provided by the Long Term Resource Monitoring Program.

1. Monitoring Rationale for Macroinvertebrates

Macroinvertebrates are an important biotic component of the Upper Mississippi River System (UMRS). They perform a significant role in the structure and function of the UMRS ecosystem including processing and transfer of organic material and nutrient cycling/spiraling. The macroinvertebrate community represents most of the primary consumer biomass/production component in the UMRS food web, thus serving as the trophic base that supports fish, waterfowl, and other animals. Changes or shifts in macroinvertebrate community composition, including the introduction of exotic species, could have significant implications for higher trophic levels and energy flow pathways in the UMRS food web. It is therefore vital to understand long-term trends in UMRS invertebrate communities to gain an understanding of ecosystem structure and function. Rather than taking a community approach, macroinvertebrate monitoring for the Long Term Resource Monitoring Program (LTRMP) is designed to focus on trends in select UMRS macroinvertebrates, largely because of the logistics of sampling and funding levels.

Relative to fish and other aquatic organisms, most benthic macroinvertebrates have very limited mobility, are less able to avoid unfavorable environmental conditions, and are sensitive to many environmental stressors. Consequently, they respond quickly to environmental changes. The presence, absence, or dominance of tolerant or sensitive species is a useful tool for detecting environmental problems.

Trend analysis of macroinvertebrates is needed to assess spatial and temporal changes in the abundance of benthic populations and to suggest potential mechanisms causing these changes. Monitoring macroinvertebrate populations and communities assists researchers evaluating the condition of the UMRS. Quantitative sampling techniques are employed to obtain information on population density and diversity. Data collected in other LTRMP components, historical information, and literature reviews are used to aid in analysis of the macroinvertebrate data.

1.1 Specific Sampling Methods for Target Taxa

In 1992, macroinvertebrate sampling was initiated in Pools 4, 8, 13, 26, and the Open Reach of the Mississippi River and La Grange Pool of the Illinois River as part of the LTRMP. Mayflies (Ephemeroptera), fingernail clams (Sphaeriidae), and the exotic Asiatic clam (*Corbicula fluminea*) were selected for monitoring. Midges (Chironomidae) were added to the monitoring scheme in 1993 and zebra mussels (*Dreissena polymorpha*) in 1995. Mayflies, fingernail clams, and midges—those species found in the soft-sediment substrate—were chosen because they play an important ecological role in the UMRS. The Asiatic clam and the zebra mussel were chosen for sampling because of their possible detrimental effects on the economy and biology of the UMRS.

1.1.1 Choosing Sample Size and Locations

Choosing the sample location. A minimum of 125 samples are taken in each study reach from a combination of randomly selected sites and locations where benthic samples previously have been collected (Appendix A). If the minimum number of samples cannot be collected, every effort must be made to obtain good coverage of the pool (or reach) and aquatic area, as well as to sample at the historical sites. Samples are allocated to aquatic areas (Table 1) based on two criteria: surface area of the aquatic area in each study reach, and productivity and variance of mayflies and fingernail clams in each aquatic area. The selection of sampling locations and sample size in each habitat (a minimum sample size of 10) varies among study reaches because of differences in habitat conditions and coverages.

Sampling sites are randomly selected within each aquatic area using geographic information system technology. The UMESC supplies each field station with Universal Transverse Mercator (UTM) coordinates of the random sampling and historical (fixed) locations and associated sample site grid numbers, along with coordinates of alternate sites and associated grid numbers. The field stations map the sampling locations using a geographic information system.

Table 1. Macroinvertebrate random sample sites by study reach and aquatic area.

Study reach	Contiguous backwater	Impounded	Side channel	Main channel border
Pool 4	57 (3) ^a	44 (1) ^b	10	10
Pool 8	31 (3)	49 (11)	19 (2)	10
Pool 13	43 (2)	46 (1)	14 (4)	15
Pool 26	40	27	34 (3)	17 (4)
Open River	—	—	64 (16)	43 (2)
La Grange Pool	24 (18)	—	35 (7)	40 (1)

^aNumbers in parentheses are historical (fixed) sites.

^bLake Pepin; Tributary Delta Lake

Delineating sample locations. Standard Ponar Grab (Ponar Grab Dredge, Wildlife Supply Company, Saginaw, Michigan) samples are taken in areas of open water or areas with floating or submersed aquatic vegetation. The Ponar Grab takes a sample area of 523 cm². If the assigned location is not at an appropriate site for macroinvertebrate Ponar Grab collections, such as in a stand of emergent vegetation, at a wing dam or dike, or at an out-of-the-water sandbar, select an alternate site in the field by moving to the nearest available site within 25 m of the original location (use the same sample grid number on the data sheet) and within the same aquatic area. If the original or nearest available site cannot be reached, fill in a data sheet with the grid number, a summary code of "4", and, in the comments, the reason for choosing an alternate site. Then select an alternate site from the alternate site map within the same aquatic area. If the site is not obtained from the alternate site map, obtain UTM coordinates using a Global Positioning System and record them on the data sheet. In addition, indicate the location on the map and note in the Comments section of the data sheet (Appendix B).

Sampling schedule. Table 2 details sampling period time frames. Sampling is completed in two consecutive weeks during the same time frame each year and must be done before mayfly emergence in all study areas except the Open River Reach. The Open River Field Station will sample after the spring flood pulse. Open River sampling may occur after mayfly emergence, therefore, care must be taken when analyzing the data.

Data collection. A field materials list is contained in Appendix C. When an appropriate site has been identified and reached, anchor the boat. Measure the depth at each site and record the value on the Macroinvertebrate Collection Sheet. Take a Ponar Grab sample.

Table 2. Sampling period time frames

Trend analysis area	Projected sampling window
Pool 4	May 1–June 14
Pool 8	May 1–June 14
Pool 13	May 1–June 14
Pool 26	April 1–June 1
Open River	Variable – after spring flood pulse
La Grange Pool	April 1–June 1

After the macroinvertebrate sample is taken, it is raised to the surface and the Ponar Grab is opened over the wash tray. Using a garden hose attached to a water pump, use river water to completely wash the benthic material from the inside of the Ponar Grab sampler into the wash tray. Wash the sample through a 1.18-mm sieve (U.S. Standard No. 16) until as much sediment as possible has been removed. Set the water pressure high enough to wash sediments through the sieve but not enough to damage organisms. (**Do not force benthic material through the sieve with your hands.**) Use the water to spread the sample evenly over the wash tray. If the field crew suspects that the Ponar Grab did not collect an adequate sample or if the jaws did not close completely, discard the sample and take another. If after three attempts the sampler will not close or take a good sample because of mussel shells, rocks, sticks, or detritus, note it in the Summary Code and Comments sections of the Macroinvertebrate Collection Sheet. Choose an alternate site following the guidelines under *Delineating sample locations*.

A smaller sample may be taken if a sample appears to contain 1,000 or more live fingernail clams. To sample an area, use a Petite Ponar Grab (Petite Ponar Grab Dredge, Wildlife Supply Company, Saginaw, Michigan). The Petite Ponar Grab takes a sample area of 232 cm². If a Petite Ponar Grab is used, mark an "E" in the Gear Code box on the Macroinvertebrate Collection Sheet (Appendix B). Use the same procedures for sampling with a Petite Ponar Grab as when sampling with a Ponar Grab.

Using entomological forceps, pick all benthic taxa from the sample. Record the number, including zero, of each of the five target taxa—mayflies, midges (≥ 1 cm), fingernail clams, Asiatic clams, and zebra mussels—in the appropriate section on the data sheet. Record other taxa found in the sample as being present or absent. Descriptions and drawings of these taxa are found in Appendix D. Before preserving or disposing of a sample, at least two people should examine the sample to ensure that no more organisms are present. Keep the taxa from the sample until it is determined whether to preserve them for quality assurance/quality control (QA/QC).

After the picking process is complete, determine whether the sample will be taken to the laboratory for QA/QC procedures. About 10% of the samples in each aquatic area are retained—12 out of 125 samples are removed to the laboratory for QA/QC. After all taxa has been picked out, select the samples (by lot) to be taken to the laboratory. Before heading into the field, prepare boxes with the appropriate number of white (discard) and black (preserve) marbles (e.g., for 20 samples sites in side channel [SC] aquatic area, the random selection box contains 2 black [preserve] marbles and 18 white [discard] marbles). Refer to Table 1 for aquatic area sample size: add the stratified random sites and historical sites for total sample sites (one sample per site). At each sampling site, withdraw one marble from the appropriate aquatic area container. If the marble is white, discard the sample. If the marble is black, save the sample for laboratory analysis. Do **not** return the marble to the box.

If the sample is chosen for laboratory analysis, place the target taxa into 2 oz. specimen vials and preserve with 70% ethanol. Concentrate the remaining material in the wash tray in one corner. Lift up the tray and tilt over a 8-, 16-, 32-, or 64-oz screw-top wide-mouth polyethylene sample bottle, and gently backflush the material into the bottle with water from a wash bottle or a hose. Use only the minimum amount of water necessary to flush out the material. For samples taken with a Petite Ponar Grab, use the same procedure. Label the bottles to indicate they contain material sampled by a Petite Ponar.

Add a rose bengal solution (made by dissolving 1 g rose bengal disodium salt in 1 L of deionized water) to the container; this process facilitates laboratory picking of organisms from detritus. The amount of stain solution added to each of the samples depends on the volume of the sample jars. Add a minimum of 4 mL of the rose bengal solution to 8-oz containers, 8 mL to 16-oz containers, 15 mL to 32-oz containers, and 30 mL to 64-oz containers. After adding the stain, fill the container with 70% ethanol to prevent desiccation of the sample. Split samples into multiple containers if there is too much material for one container. Shake each container vigorously and allow it to sit a minimum of 48 h before sorting the sample.

All macroinvertebrate samples retained for further analysis must be labeled in the field immediately upon collection. Place printed labels (Figure) on the inside **and** outside of the mayfly, midge, fingernail clam, Asiatic clam, zebra mussel, and other taxa vials; and the remaining macroinvertebrate sample containers. Use water-resistant paper for the inside labels and standard adhesive labels for the outside of the containers. Print as much information on the labels as practical before going into the field. In the field, clearly print all remaining information on the inside and outside labels with a soft lead pencil or waterproof ink.

Note on the Macroinvertebrate Collection Sheet (Appendix B) the percentage or absence of aquatic vegetation (submersed and floating leaf) in the column of water and sediment through which the Ponar Grab is falling. Characterize the type and percentage of vegetation and open water in a 15-m radius from the boat by filling in the appropriate codes in the Site Description section. Record the general category of predominant sediment type. Record the percentage of dead shells and detritus present in the wash frame by filling in the appropriate codes in the Ponar Grab Sample Description section. Complete all remaining fields on the data sheet.

Immediately upon returning to the field station, record information about each sample for the permanent record (Ohio Environmental Protection Agency 1989; Klemm et al. 1990). Use bar codes to aid in tracking data sheets—place a bar code on the Macroinvertebrate Log Sheet (Appendix E) and a matching bar code on the Macroinvertebrate Collection Sheet. Send copies of the data sheets to the data entry contractor (National Business Systems, Faribault, Michigan). Send copies of the log sheets to the UMESC macroinvertebrate coordinator; file the original data and log sheets at the field stations.

Collection of benthic samples can involve risks to personal safety. Ponar grab samplers have safety locking pins that must be in place to prevent injury. Winch handles can cause injury when they are spinning. Persons using these devices should become familiar with the hazards involved and should establish appropriate safety practices before going out in the field. Ponar Grab samplers and winches should be examined for mechanical defects before use (Klemm et al. 1990). All persons working with or near the Ponar Grab should wear adequate foot protection (e.g., steel-toed boots). Wear waterproof gloves when handling sediments that could possibly be chemically or biologically contaminated.

Label for Inside and Outside of Vials of Target Taxa

Field sample–target taxa

Field station #:
Grid #:
Year:
Circle one: mayflies, fingernail clams, midges, *Corbicula*, or zebra mussels

Label for Inside and Outside of Vials of Other Taxa

Field sample–other taxa

Field station #:
Grid #:
Year:

**Label for Inside and Outside of Remaining
Macroinvertebrate and Detritus Containers**

Field sample

Field station #:
Grid #:
Year:
Number of containers: _____ of _____ Petite Ponar Sample: Y or N

**Label for Inside and Outside of Vials
of Laboratory Target Taxa**

Laboratory–target taxa

Field station #:
Grid #:
Year:
Circle one: mayflies, fingernail clams, midges, zebra mussels, or *Corbicula*

**Label for Inside and Outside of Vials
of Laboratory Other Taxa**

Laboratory–other taxa

Field station #:
Grid #:
Year:

Figure. Labels for macroinvertebrate samples

1.2 Laboratory Protocol

In the laboratory, sort the QA/QC samples to evaluate efficiency of picking samples in the field. A laboratory materials list is in Appendix F. The 70% ethanol used to preserve the samples is decanted before sorting. Wear protective clothing, including a laboratory coat, eye goggles, and latex gloves, and use a ventilation hood if available, while processing the samples.

Pour the contents of the sample container into the mesh sieve (U.S. Standard No. 30) of the wash bucket. A less cumbersome sieve such as a U.S. Standard No. 16 or No. 30 brass testing sieve may be used. Rinse the sample container twice with tap water and pour the contents and water into the sieve. Return the label to the sample container. Place the wash bucket into a container in the sink and gently run a stream of water over the sample in the wash bucket for at least 15 min. Water pressure should be low enough so macroinvertebrates are not impinged in the sieve. Allow the sample to sit in the standing water for 30 min and then dump out the standing water.

Transfer the contents of the wash bucket into the original sample container. Rinse the sieve with water or a water-filled squirt bottle to ensure that the sample is completely transferred into the sample container. Add enough water to cover the sample.

Place enough of the washed sample in a white processing tray to cover the bottom of the tray. Remove all taxa from the sample. Use the descriptions and drawings of these taxa in Appendix D to assist in identification. After initially sorting through the benthic material, mix the sample and sort again. Another individual should mix the sample and sort through it a third time. Place this sorted portion of the sample into an empty container and add another aliquot of unpicked sample to the processing tray. This process is continued until all of the sample (all containers if multiple containers were used at one site) has been sorted.

Complete a Macroinvertebrate Laboratory Sheet (Appendix G) for each sample—Bar Code, Field Station #, Sample Grid, Date Collected, Date Sorted, Number of Field Detritus Containers (original field sample containers), Number of Lab Taxa Vials, Subsampled Sample, Sorting Time. Record the number of organisms of each target taxa found, including zero. Record other taxa found in the sample as being present or absent. Do not include the number of taxa that were picked in the field. Information such as the size (large, medium, small) and the amount of detritus should be added to the Comments section. Complete the Macroinvertebrate Laboratory Sheet (Appendix G) with the Recorder Code and the Crew Leader Signature.

Place all macroinvertebrates from the same taxonomic group for target taxa into separate vials, other taxa in a single vial. When finished adding invertebrates to a vial, fill each vial with a 70% ethanol solution. Each vial for the taxonomic groups should have an internal label of water-resistant paper. Place printed labels (Figure) on the outside of the taxa vials. Clearly print the required data on the labels with a soft lead pencil. Place all the vials from one sample into a zipper-lock (reclosable) plastic bag. Label the outside of the zipper-lock bag with field station, grid number, and year using a permanent marker and place a label in the bag with the same information. Place the zipper-lock bags into a storage container, keeping the vials upright. When the processing of samples is complete, ship the vials containing the taxa, along with the corresponding field sample data sheets and taxa vials, and copies of the laboratory data sheets to the UMESC macroinvertebrate coordinator. After the entire sample has been sorted, properly dispose of the remaining detrital and substrate material.

Changes to the LTRMP macroinvertebrate sampling procedures can be found in Appendix H.

2. References

- Klemm, D. J., P. A. Lewis, F. F. Fulk, and J. M. Lazorchak. 1990. Macroinvertebrate field and laboratory methods for evaluating the biological integrity of surface waters. U.S. Environmental Protection Agency, Cincinnati, Ohio. EPA/600/4-90/030. 256 pp.
- Ohio Environmental Protection Agency. 1989. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Ohio Environmental Protection Agency, Columbus. V1-1 to V4-43.
- U.S. Fish and Wildlife Service. 1993. Operating Plan for the Upper Mississippi River System Long Term Resource Monitoring Program. Environmental Management Technical Center, Onalaska, Wisconsin, Revised September 1993. EMTC 91-P002R. 179 pp. (NTIS #PB94-160199)

Appendix A. References Used to Choose Historical (Fixed) Sample Sites

- Anderson, K. B. 1977. *Musculium transversum* in the Illinois River and an acute potassium bioassay method for the species. M.S. Thesis, Western Illinois University, Macomb. 79 pp.
- Brewer, S. K. 1992. Community structure of benthic macroinvertebrates in Navigation Pool No. 8, Upper Mississippi River: Comparisons between 1975 and 1990. M.S. Thesis, University of Wisconsin–La Crosse. 47 pp.
- Colbert, B. K., J. E. Scott, J. H. Johnson, and R. C. Solomon. 1975. Environmental inventory and assessment of Navigation Pools 24, 25, and 26, Upper Mississippi and Lower Illinois Rivers: An aquatic analysis. Technical Report Y-75-2, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. 137 pp. + Appendixes
- Elstad, C. A. 1977. Macrobenthic survey of Navigation Pool No. 8 of the Upper Mississippi River, with special reference to ecological relationships. M.S. Thesis, University of Wisconsin–La Crosse. 231 pp.
- Emge, W. P., R. C. Solomon, J. H. Johnson, C. R. Bingham, B. K. Colbert, and R. W. Hall. 1974. Physical, biological, and chemical inventory of twenty-three side channels and four river border areas, middle Mississippi River. Miscellaneous Paper Y-74-5, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. 163 pp. + Appendixes
- Hubert, W. A., G. E. Darnell, and D. E. Dalk. 1983. Evaluation of wintering benthic macroinvertebrates of Pool 13 of the Upper Mississippi River. U.S. Army Corps of Engineers, Rock Island District, Rock Island, Illinois. Letter Order NCR-LO-83-C12. 30 pp.
- North Star Research Institute, Environmental Systems Division. 1973. Environmental impact assessment study of the northern section of the Upper Mississippi River for the St. Paul District Corps of Engineers under contract no. DACW37-73-C-0059. 295 pp.
- Paloumpis, A. A., and W. C. Starrett. 1960. An ecological study of benthic organisms in three Illinois River flood plain lakes. *American Midland Naturalist* 64:406–435.
- Seagle, H. H., and F. H. Zumwalt. 1981. Evaluation of the effects of tow passage on aquatic macroinvertebrate drift in Pool 26, Mississippi River. Upper Mississippi River Basin Association Contract Number 881-305. Minneapolis, Minnesota. 91 pp.

Appendix B. Long Term Resource Monitoring Program Macroinvertebrate Collection Sheet

Macroinvertebrate Collection Sheet

Long Term Resource Monitoring Program
Upper Midwest Environmental Sciences Center
575 Lester Avenue, Onalaska, WI 54650

Attach Bar
Code Here

Field Station <input style="width: 100%; height: 20px;" type="text"/>	Date <table style="width: 100%; text-align: center;"> <tr> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> </tr> <tr> <td>mm</td> <td>dd</td> <td colspan="5">yyyy</td> <td></td> <td></td> </tr> </table>									mm	dd	yyyy							Sample Grid <table style="width: 100%; text-align: center;"> <tr> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px;"></td> </tr> <tr> <td colspan="4">Numeric Field</td> </tr> </table>					Numeric Field				<table style="width: 100%; border: 1px solid black;"> <tr> <td style="border: 1px solid black; width: 50%; height: 20px;"></td> <td style="border: 1px solid black; width: 5%; text-align: center;">E</td> </tr> <tr> <td style="border: 1px solid black; width: 50%; height: 20px;"></td> <td style="border: 1px solid black; width: 5%; text-align: center;">N</td> </tr> <tr> <td style="border: 1px solid black; width: 50%; text-align: center;">Zone</td> <td style="border: 1px solid black; width: 5%;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50%; text-align: center;">PDOP</td> <td style="border: 1px solid black; width: 5%;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50%; text-align: center;">Gear Code</td> <td style="border: 1px solid black; width: 5%;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50%; text-align: center;">Laboratory Sample Taken</td> <td style="border: 1px solid black; width: 5%;"></td> </tr> </table>		E		N	Zone		PDOP		Gear Code		Laboratory Sample Taken	
mm	dd	yyyy																																						
Numeric Field																																								
	E																																							
	N																																							
Zone																																								
PDOP																																								
Gear Code																																								
Laboratory Sample Taken																																								
Project Code <input style="width: 100%; height: 20px;" type="text"/>	Habitat Class <input style="width: 100%; height: 20px;" type="text"/>	River Mile <input style="width: 100%; height: 20px;" type="text"/>	Subsample Taken <input style="width: 100%; height: 20px;" type="text"/> (Y or N)																																					
<p style="font-size: small;"> M=RTA Monitoring B=Bio-Response E=Experimental R=Research MCB=Main Channel/Border TD=Lake Trench MP=Impounded SC=Side Channel BWC=Contiguous Backwater </p>																																								
Depth (M) <input style="width: 100%; height: 20px;" type="text"/>	# Containers <input style="width: 100%; height: 20px;" type="text"/>	Summary Code <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 1. Sample taken 2. Sample taken but not kept due to hard substrate 3. Sample taken but not kept due to detritus, shells, etc. 4. Other </p>																																						
% Submersed and Floating-Leaf Vegetation (Ponar Only) <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>		Predominant Substrate <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 1 = Hard Clay 2 = Silt/Clay 3 = Mostly Silt/Clay with Sand 4 = Mostly Sand with Silt/Clay 5 = Sand 6 = Gravel/Rock Fine Organic Material </p> <input style="width: 100%; height: 20px;" type="text"/> (Y or N)	Ponar Sample Description (Percentage of Whole Tray) <table style="width: 100%;"> <tr> <td style="width: 50%;"> Shells <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p> </td> <td style="width: 50%;"> Detritus <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p> </td> </tr> </table>	Shells <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>	Detritus <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>																																			
Shells <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>	Detritus <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>																																							
Site Description (Describe 15-m Radius Around Boat)																																								
Submersed Vegetation <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>	Floating-Leaf <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>	Emergent Vegetation <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>	Open Water <input style="width: 100%; height: 20px;" type="text"/> <p style="font-size: x-small;"> 0 = 0% 1 = 1% - 20% 2 = 21% - 50% 3 = 51% - 90% 4 = 91% - 100% </p>																																					
Macroinvertebrate Abundance																																								
Ephemeroptera (Mayflies) <input style="width: 100%; height: 20px;" type="text"/>	Sphaeriidae (Fingernail clams) <input style="width: 100%; height: 20px;" type="text"/>	Corbicula spp. (Asiatic clam) <input style="width: 100%; height: 20px;" type="text"/>	Chironomidae (Midges) <input style="width: 100%; height: 20px;" type="text"/>																																					
Dreissena polymorpha (Zebra Mussels) <input style="width: 100%; height: 20px;" type="text"/>																																								
Absence/Presence Data A=Absent P=Present																																								
Odonata (Dragonflies and Damselflies) <input style="width: 100%; height: 20px;" type="text"/>	Plecoptera (Stoneflies) <input style="width: 100%; height: 20px;" type="text"/>	Trichoptera (Caddisflies) <input style="width: 100%; height: 20px;" type="text"/>	Diptera (Aquatic flies excluding Chironomids) <input style="width: 100%; height: 20px;" type="text"/>																																					
Oligochaeta (Aquatic worms and leeches) <input style="width: 100%; height: 20px;" type="text"/>	Decapoda (Freshwater shrimp and crayfish) <input style="width: 100%; height: 20px;" type="text"/>	Amphipoda (Scuds) <input style="width: 100%; height: 20px;" type="text"/>	Unionidae (Freshwater mussels) <input style="width: 100%; height: 20px;" type="text"/>																																					
Gastropoda (Snails) <input style="width: 100%; height: 20px;" type="text"/>																																								
Comments: <input style="width: 100%; height: 20px;" type="text"/> <input style="width: 100%; height: 20px;" type="text"/> <input style="width: 100%; height: 20px;" type="text"/>																																								
Recorder Code <input style="width: 100%; height: 20px;" type="text"/>	Data collected on this form were collected in compliance with current LTRMP procedures and are to the best of my knowledge complete and free of errors.																																							
Crew Leader Signatures: _____																																								

*Long Term Resource Monitoring Program
Macroinvertebrate Collection Sheet Instructions*

<i>Field</i>	<i>Explanation</i>
Attach Bar Code Here	Affix bar code sticker in the space provided in the upper right margin upon return to the office.
Header Block	
Field Station	One-digit field station number: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>1 = Lake City, Minnesota</p> <p>2 = Onalaska, Wisconsin</p> <p>3 = Bellevue, Iowa</p> </div> <div style="width: 45%;"> <p>4 = Alton, Illinois</p> <p>5 = Cape Girardeau, Missouri</p> <p>6 = Havana, Illinois</p> </div> </div>
Date	The month, day, and year the sample was collected.
Sample Grid	Grid numbers are supplied to field stations by the UMESC and are unique descriptors for each sampling site location (numeric).
New measured UTM Coordinates	(Optional) The UTM coordinates where samples are taken are recorded with a GPS unit. These coordinates are important for linkage with other spatial data and will allow future samples to be collected at the same location.
Zone	(Optional) The UTM zone where the coordinates are located should be entered in this field. Pools 4, 8, 13, 26, and part of the Open River and La Grange Pool are located in Zones 15 and 16.
PDOP (Position dilution of precision)	(Optional) A PDOP value is recorded with a GPS unit at each site. This value will help determine the confidence of the UTM coordinates.
Project Code	This four-digit alphanumeric space is used to distinguish among routine monitoring, biological response HREP monitoring, exploratory sampling, research, and non-biological response HREP monitoring. Project code identifiers are: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>M = RTA Monitoring</p> <p>B = Bio-Response</p> <p>E = Experimental</p> <p>R = Research</p> </div> <div style="width: 45%;"></div> </div>
Habitat Class	The aquatic area for each site is provided to the field stations by the UMESC with the coordinates and sample site numbers. Class abbreviation should be left-justified. <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MCB = Main Channel/Border</p> <p>TDL = Lake Pepin</p> <p>IMP = Impounded</p> </div> <div style="width: 45%;"> <p>SC = Side Channel</p> <p>BWC = Contiguous Backwater</p> </div> </div>

<i>Field</i>	<i>Explanation</i>										
Fine Organic Material	Code if any fine organic material (characterized by black coloration and odor) is present in the sample. (Y = Yes, N = No)										
Ponar Grab Sample Description Block											
Shells	This is a characterization of the percentage of dead shells in the sample wash frame. <table border="0" style="width: 100%;"> <tr> <td>0 = 0%</td> <td>3 = 51% – 90%</td> </tr> <tr> <td>1 = 1% – 20%</td> <td>4 = 91% – 100%</td> </tr> <tr> <td>2 = 21% – 50%</td> <td></td> </tr> </table>	0 = 0%	3 = 51% – 90%	1 = 1% – 20%	4 = 91% – 100%	2 = 21% – 50%					
0 = 0%	3 = 51% – 90%										
1 = 1% – 20%	4 = 91% – 100%										
2 = 21% – 50%											
Detritus	This is a characterization of the percentage of detritus (fibrous material on the surface and within the sediment) in the sample wash frame. <table border="0" style="width: 100%;"> <tr> <td>0 = 0%</td> <td>3 = 51% – 90%</td> </tr> <tr> <td>1 = 1% – 20%</td> <td>4 = 91% – 100%</td> </tr> <tr> <td>2 = 21% – 50%</td> <td></td> </tr> </table>	0 = 0%	3 = 51% – 90%	1 = 1% – 20%	4 = 91% – 100%	2 = 21% – 50%					
0 = 0%	3 = 51% – 90%										
1 = 1% – 20%	4 = 91% – 100%										
2 = 21% – 50%											
Site Description Block											
Submersed Vegetation, Floating-Leaf, Emergent Vegetation, and Open Water (%)	This is a characterization of the type and percentage of vegetation and open water in a 15-m radius from the boat. There is a numeric code for each of the four categories (submersed, floating, emergent, and open water). Qualitative observations of the sampling area help to relate macroinvertebrates to aquatic areas. <table border="0" style="width: 100%;"> <tr> <td>0 = 0%</td> <td>3 = 51% – 90%</td> </tr> <tr> <td>1 = 1% – 20%</td> <td>4 = 91% – 100%</td> </tr> <tr> <td>2 = 21% – 50%</td> <td></td> </tr> </table>	0 = 0%	3 = 51% – 90%	1 = 1% – 20%	4 = 91% – 100%	2 = 21% – 50%					
0 = 0%	3 = 51% – 90%										
1 = 1% – 20%	4 = 91% – 100%										
2 = 21% – 50%											
Macroinvertebrates Block											
Macroinvertebrate Abundance	The number of individuals of each of the five target groups, including zero, is recorded in this section. <table border="0" style="width: 100%;"> <tr> <td>Ephemeroptera (Mayflies)</td> <td>Chironomidae (Midges)</td> </tr> <tr> <td>Sphaeriidae (Fingernail clams)</td> <td><i>Dreissena polymorpha</i> (Zebra Mussels)</td> </tr> <tr> <td><i>Corbicula</i> spp. (Asiatic clam)</td> <td></td> </tr> </table>	Ephemeroptera (Mayflies)	Chironomidae (Midges)	Sphaeriidae (Fingernail clams)	<i>Dreissena polymorpha</i> (Zebra Mussels)	<i>Corbicula</i> spp. (Asiatic clam)					
Ephemeroptera (Mayflies)	Chironomidae (Midges)										
Sphaeriidae (Fingernail clams)	<i>Dreissena polymorpha</i> (Zebra Mussels)										
<i>Corbicula</i> spp. (Asiatic clam)											
Absence/Presence Data	Code if the following taxa are absent or present in the sample. (A=Absent, P=Present) <table border="0" style="width: 100%;"> <tr> <td>Odonata (Dragonflies and Damselflies)</td> <td>Oligochaeta (Aquatic worms and leeches)</td> </tr> <tr> <td>Plecoptera (Stoneflies)</td> <td>Decapoda (Freshwater shrimp and crayfish)</td> </tr> <tr> <td>Trichoptera (Caddisflies)</td> <td>Amphipoda (Scuds)</td> </tr> <tr> <td>Diptera (Aquatic flies excluding Chironomids)</td> <td>Gastropoda (Snails)</td> </tr> <tr> <td>Unionidae (Freshwater mussels)</td> <td></td> </tr> </table>	Odonata (Dragonflies and Damselflies)	Oligochaeta (Aquatic worms and leeches)	Plecoptera (Stoneflies)	Decapoda (Freshwater shrimp and crayfish)	Trichoptera (Caddisflies)	Amphipoda (Scuds)	Diptera (Aquatic flies excluding Chironomids)	Gastropoda (Snails)	Unionidae (Freshwater mussels)	
Odonata (Dragonflies and Damselflies)	Oligochaeta (Aquatic worms and leeches)										
Plecoptera (Stoneflies)	Decapoda (Freshwater shrimp and crayfish)										
Trichoptera (Caddisflies)	Amphipoda (Scuds)										
Diptera (Aquatic flies excluding Chironomids)	Gastropoda (Snails)										
Unionidae (Freshwater mussels)											

<i>Field</i>	<i>Explanation</i>
Comment Block	
Comments	This section should be used to comment on any unusual conditions at the sampling location or Ponar Grab sampling site. Specific information as to why a site was abandoned should be listed here. Notes on any unusual or abundant organisms also could be mentioned here (80-character field).
QA/QC Block	
Recorder Code	This is the unique user ID assigned to the person who filled in the data sheet. These IDs are assigned by the UMESC.
Crew Leader Signature	The crew leader signs the data sheet to certify that the samples were collected in compliance with current LTRMP procedures and the data entered on the form are, to the best of her/his knowledge, complete and free of errors. This signature underscores the importance of adhering to LTRMP methods and is one of the chain-of-custody procedures.

Appendix C. Field Materials

Sluice tray
Ponar Grab wash tray - 1.18-mm mesh size
Ponar Grab
Petite Ponar Grab
Boom with winch
Wash bucket or sieve (U.S. Standard No. 16 or 30)
Leather gloves
Water pump, hose, and electric cord
70% ethanol
Rose bengal solution and measuring cup
Distilled water
Plastic specimen vials - 2 oz
Laboratory sample containers - 8, 16, 32, and 64 oz.
Field identification sheets
GPS unit
Wash bottles
Device for depth measurements
Data sheets - Rite in the Rain (J. L. Darling, Corp., Tacoma, Washington)
Pens and pencils
SRS maps
Sample labels
Boxes and marbles
Entomological forceps

Appendix D. Keys of Target Taxa

Keys of Target Taxa can be found in the following references:

Eddy, S., and A. C. Hodson. 1961. Taxonomic keys to the common animals of the North Central States. Third edition. The Burgess Publishing Company, Minneapolis, Minnesota. 162 pp.

Lehmkuhl, D. M. 1979. How to know the aquatic insects, Pictured Key Nature Series. Wm. C. Brown Publishers. 168 pp.

Leonard, J. W., and F. A. Leonard. 1962. Mayflies of Michigan trout streams. Cranbrook Institute of Science, Bloomfield Hills, Michigan. 139 pp.

Mason, W. T. 1973. An introduction to the identification of chironomid larvae. Analytical Quality Control Laboratory, National Environmental Research Center, U.S. Environmental Protection Agency, Cincinnati, Ohio. 90 pp.

Smith, D. G. 1986. Keys to the freshwater macroinvertebrates of Massachusetts. No. 1: *Mollusca pelecypoda* (clams, mussels). In cooperation with The Commonwealth of Massachusetts, Technical Services Branch of the Department of Environmental Quality Engineering, Division of Water Pollution Control, Westborough, Massachusetts. Publication 14,676-56-300-12-86-CR. 52 pp.

Thorp, J. H., and A. P. Covich, editors. 1991. Ecology and classification of North American freshwater invertebrates. Academic Press, Inc., Orlando, Florida. 911 pp.

Appendix E. Long Term Resource Monitoring Program Macroinvertebrate Log Sheet

Macroinvertebrate Log Sheet

Long Term Resource Monitoring Program
Upper Midwest Environmental Sciences Center
575 Lester Avenue, Onalaska, WI 54650

Field Station # <input style="width: 30px; height: 20px;" type="text"/>	Date Submitted <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; border: 1px solid black; text-align: center;"> </td> <td style="width: 25%; border: 1px solid black; text-align: center;"> </td> <td style="width: 25%; border: 1px solid black; text-align: center;"> </td> <td style="width: 25%; border: 1px solid black; text-align: center;"> </td> </tr> <tr> <td style="text-align: center; font-size: small;">mm</td> <td style="text-align: center; font-size: small;">dd</td> <td colspan="2" style="text-align: center; font-size: small;">yyyy</td> </tr> </table>					mm	dd	yyyy		<i>Send a copy of this completed log sheet to UMESC when data sheets are submitted for data entry. Retain the original of this log for field station records.</i>		
mm	dd	yyyy										
Data Sheet Bar Code	Preliminary QA Check											
	Station		UMESC									
	Recorder Code	Initial	Recorder Code	Initial								
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> <td style="width: 25%;"> </td> </tr> </table>					

UMESC 04/30/99 macrolog2.p65

Appendix F. Laboratory Materials

Processing trays

Entomological forceps

Wash bottles

Dissecting scope or magnifier

Extra 8-, 16-, 32-, and 64-oz containers

Sample vials, 2 oz

Wash bucket or sieve (U.S. Standard No. 16 or 30)

Data sheets

Labels

70% ethanol

Appendix G. Long Term Resource Monitoring Program Macroinvertebrate Laboratory Sheet

Macroinvertebrate Laboratory Sheet

Long Term Resource Monitoring Program
Upper Midwest Environmental Sciences Center
575 Lester Avenue, Onalaska, WI 54650

Bar Code

Field Station # <input style="width: 100%;" type="text"/>	Sample Grid <input style="width: 100%;" type="text"/>	Date Collected <input style="width: 100%;" type="text"/> <small>M M D D Y Y Y Y</small>	Date Sorted <input style="width: 100%;" type="text"/> <small>M M D D Y Y Y Y</small>	
Number of Field Detritus Containers <input style="width: 100%;" type="text"/>	Macroinvertebrates			
Number of Lab Taxa Vials <input style="width: 100%;" type="text"/>	Key Taxa			
Subsampled Sample (Y or N) <input style="width: 100%;" type="text"/>	Ephemeroptera (Mayflies) <input style="width: 100%;" type="text"/>	Sphaeriidae (Fingernail clams) <input style="width: 100%;" type="text"/>		
	<i>Corbicula</i> spp. (Asiatic clam) <input style="width: 100%;" type="text"/>	Chironomidae (Midges) <input style="width: 100%;" type="text"/>		
	<i>Dreissena polymorpha</i> (Zebra Mussels) <input style="width: 100%;" type="text"/>			
"Other Taxa"				
Absence/Presence Data A=Absent P=Present				
Odonata (Dragonflies and Damselflies) <input style="width: 100%;" type="text"/>	Plecoptera (Stoneflies) <input style="width: 100%;" type="text"/>	Trichoptera (Caddisflies) <input style="width: 100%;" type="text"/>	Diptera (Aquatic flies excluding <i>Chironomids</i>) <input style="width: 100%;" type="text"/>	
Oligochaeta (Aquatic worms and leeches) <input style="width: 100%;" type="text"/>	Decapoda (Freshwater shrimp and crayfish) <input style="width: 100%;" type="text"/>	Amphipoda (Scuds) <input style="width: 100%;" type="text"/>	Gastropoda (Snails) <input style="width: 100%;" type="text"/>	Unionidae (Freshwater mussels) <input style="width: 100%;" type="text"/>
Comments: _____ _____ _____				Sorting Time <input style="width: 100%;" type="text"/> Hour(s)
Recorder Code <input style="width: 100%;" type="text"/>				
Data collected on this form were collected in compliance with current LTRMP procedures and are to the best of my knowledge complete and free of errors.				
Crew Leader Signature: _____				UMESC 05/03/99 macrolab2.pr4

**Appendix H. Changes Made to
Long Term Resource Monitoring Program
Macroinvertebrate Procedures
since 1992**

- Wash tray sieve size was changed from U.S. standard sieve No. 30 (595 μm) in 1992 to a U.S. Standard No. 16 (1.18-mm sieve) in 1993.
- The following fields were added to the data sheet in 1993: bar code, river mile, laboratory (QA/QC) sample taken, percent of dead shells and detritus in wash frame, and fine organic material present. In 1994, substrate sample taken was added.
- Chironomids (midges) were added to the target taxa list in 1993.
- *Dreissena polymorpha* (zebra mussels) were added to the target taxa list in 1995.
- In 1997, subsampling procedure was replaced with Petite Ponar sampling.
- Beginning in 1998, absence/presence data was collected on Odonata (Dragonflies and Damselflies), Oligochaeta (Aquatic worms and leeches), Plecoptera (Stoneflies), Decapoda (Freshwater shrimp and crayfish), Trichoptera (Caddisflies), Amphipoda (Scuds), Diptera (Aquatic flies excluding Chironomids), Gastropoda (Snails), and Unionidae (Freshwater mussels).

The Long Term Resource Monitoring Program (LTRMP) for the Upper Mississippi River System was authorized under the Water Resources Development Act of 1986 as an element of the Environmental Management Program. The mission of the LTRMP is to provide river managers with information for maintaining the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character. The LTRMP is a cooperative effort by the U.S. Geological Survey, the U.S. Army Corps of Engineers, and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin.

