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**MISSISSIPPI RIVER  
RESEARCH CONSORTIUM, INC.**

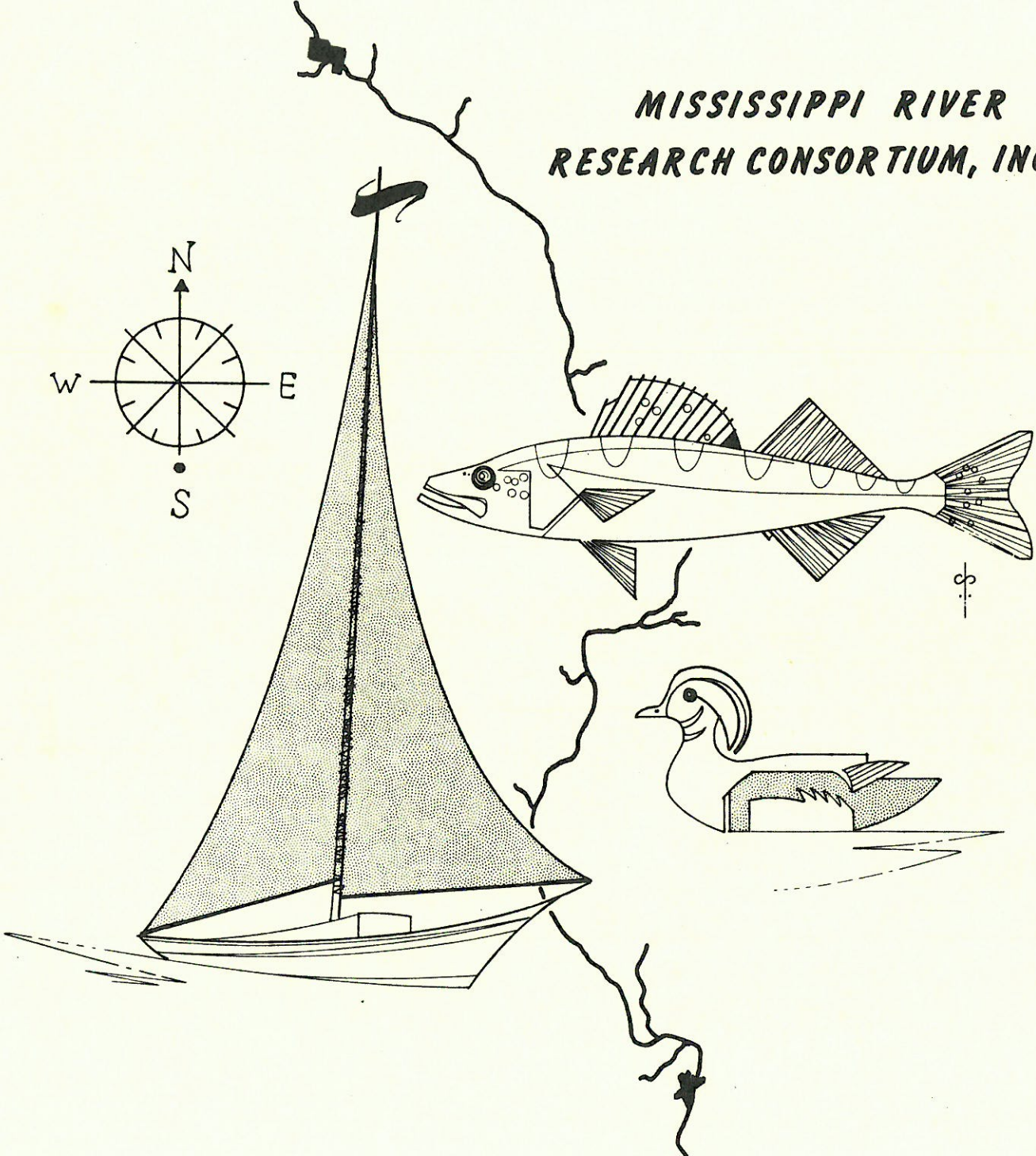


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PROGRAM ARRANGEMENTS AND OFFICERS

21th Annual Meeting of the Mississippi River Research Consortium

1989-90 Board of Directors

Dr. Larry Jahn, Western Illinois University, Macomb, IL

Mr. Jerry Rasmussen, U.S. Fish and Wildlife Service,  
Environmental Management Technical Center, Onalaska, WI

Dr. Bill LeGrand, University of Wisconsin-Stevens Point,  
Stevens Point, WI

Exhibits Committee

Mr. Barry Drazkowski, Environmental Management Tech Center  
Mr. Mark Lastrup, Environmental Management Tech Center  
Dr. James Davies II, Environmental Management Tech Center  
Mr. James Rogala, Environmental Management Tech Center

Liaison with the Holiday Inn

Ms. Mary Mackrill, Environmental Management Tech Center

Preregistration

Ms. Mary Mackrill, Environmental Management Tech Center

PROGRAM SCHEDULE

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

21st ANNUAL MEETING  
La Crosse, WI Holiday Inn

Thursday, April 27, 1989

REGISTRATION

7:30 - 8:15am

INTRODUCTION

8:20 - 8:30am Welcoming Remarks: J. Rasmussen

SESSION 1 Moderator: R. Anderson

8:30 - 9:30am KEYNOTE ADDRESS Energy Systems Overview of the Mississippi River Basin. H. T. Odum, C. D. Diamond, M. T. Brown, and R. C. Murphy.

9:30 -10:00am Questions and discussion.

10:00 -10:20am Break

10:20 -10:40am Development of a geographic information system data base as a management tool for a biologically unique river basin. C. J. O'Bara, A. G. Bailey, and Y. Robinet-Clark.

10:40- 11:00am Pool 26 water chemistry: the first year of LTRM. R. V. Anderson, J. W. Grubaugh, D. B. Markillie, and F. A. Cronin.

11:00- 11:20am Paddlefish movements and habitat use in Pool 13 of the Upper Mississippi River during a drought year. C. T. Moen, D. L. Scarnecchia, and J. S. Ramsey.

11:20- 11:40am Rationale for a harvest limit for paddlefish (Polyodon spathula) on the upper Mississippi River. D. L. Scarnecchia, T. W. Gengerke, and C. T. Moen.

11:40- 12:00pm Habitat use by shovelnose sturgeon in Pool 13, Upper Mississippi River, during extreme low flow. G. L. Curtis, J. S. Ramsey, and D. L. Scarnecchia.

12:00- 1:00pm Lunch



SESSION 2 Moderator: N. Bhowmik

- 1:00- 1:20pm           Mussels of Pool 19, 75 years behind a dam. R. V. Anderson, J. W. Grubaugh, R. E. Sparks, and K. D. Blodgett.
- 1:20- 1:40pm           Density, diversity and size/age variation in mussel beds in the Upper Mississippi River. E. T. Cawley.
- 1:40- 2:00pm           Shoreline collections of naiad mollusks (Unionidae). Lower St. Croix Falls, WI to near Stillwater, MN. M. E. Havlik and J. A. Frink.
- 2:00- 2:20pm           Effects of a low-head dam replacement on a naiad mollusk population (Unionidae), Steel Dam, Rock River, Milan, IL. M. E. Havlik and J. A. Frink.
- 2:20- 2:40pm           Distribution and relative abundance of freshwater mussels (Naiadacea) in the St. Croix National Scenic Riverway. T. J. Doolittle.
- 2:40- 3:00pm           Results of baseline sampling of freshwater mussel communities for long-term monitoring of the Saint Croix River National Scenic Riverway. D. J. Heath.
- 3:00- 3:20pm           BREAK

SESSION 3 Moderator: K. S. Lubinski

- 3:20- 3:40pm           The effects of commercial traffic on freshwater mussels: baseline studies. A. C. Miller and B. S. Payne.
- 3:40- 4:00pm           Mussel in a fast track. J. L. Owens, R. V. Anderson, and J. W. Grubaugh.
- 4:00- 4:20pm           Culture of freshwater mussels: prospects for success. S. J. Zigler, L. Holland-Bartels, and D. L. Waller.
- 4:20- 4:40pm           Pre- and postconstruction field studies: partial closure of Ackerman's cut near RM 614, Mississippi River. Tatsuaki Nakato and Keiichi Toda.

- 11:00- 11:20am Variations in capture efficiency of a seine in riverine habitats. M. R. Dewey and L. Holland-Bartels.
- 11:20- 11:40am Microhabitat utilization of a main channel border island complex by young-of-the-year fishes. M. D. Schueller, L. Holland-Bartels, and M. R. Dewey.
- 11:40- 12:00pm Intramucilaginous diatom floras of the colonial ciliate Ophrydium versatile from Itasca State Park, MN. D. B. Czarnecki.
- 12:00- 12:20pm A tick attack II: more lyme disease on the St. Croix River. A. R. Weisbrod.

## ACKNOWLEDGMENTS

The following persons and institutions have contributed substantially to the planning, execution, support, and ultimately, the success of the 21st Annual Meeting. The 1989-90 Board of Directors gratefully acknowledges their involvement.

### Meeting Arrangements

Jerry L. Rasmussen, Environmental Management Technical Center, Onalaska, WI

### Mailing List, Newsletters, Program and Registration

Mary M. Mackrill, Environmental Management Technical Center, Onalaska, WI

### Technical Session Moderators

Rick Anderson, Western Illinois University, Macomb, IL  
Nani Bhowmik, Illinois State Water Survey, Champaign, IL  
Ken Lubinski, Environmental Mgmt Tech Center, Onalaska, WI  
K. Douglas Blodgett, IL Natural History Survey, Havana, IL  
Edward Cawley, Loras College, Dubuque, IA

### Assistance with Visual Aids

Peter Boma, Environmental Management Technical Center  
Jim Rogala, Environmental Management Technical Center  
Randy Burkhardt, Environmental Mgmt Technical Center  
Mark Laustrup, Environmental Mgmt Technical Center  
Barry Drazkowski, Environmental Mgmt Technical Center  
James Davies, II, Environmental Mgmt Technical Center

PAST MEETINGS AND OFFICERS  
OF THE  
MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

<u>Meeting</u>	<u>Year</u>	<u>Place</u>	<u>President</u>
1st	1968	St. Mary's College, Winona	Brother George Pahl
2nd	1969	Wisconsin State Univ, La Crosse	Dr. Thomas Claflin
3rd	1970	Winona State College, Winona	Dr. Calvin Fremling
4th	1971	St. Cloud State College, St. Cloud	Dr. Joseph Hopwood
5th	1972	Loras College, Dubuque	Dr. Joseph Kapler
6th	1973	Quincy College, Quincy	Rev. John Ostdiek
7th	1974	No Meeting	
8th	1975	Monmouth College, Monmouth	Dr. Jacob Verduin
9th	1976	St. Mary's College, Winona	Mr. Rory Vose
10th	1977	Winona State University, Winona	Dr. Dennis Nielsen
11th	1978	University of Wisconsin-La Crosse	Dr. Ronald Rada
12th	1979	Cancelled	Dr. Edward Cawley
13th	1980	Loras College, Dubuque	Dr. Edward Cawley
14th	1981	Ramada Inn, La Crosse	Mr. M. Vanderford
			<u>Executive Committee</u>
15th	1982	Radisson Hotel, La Crosse	Dr. R. V. Anderson Dr. D. McConville Dr. J. G. Wiener
16th	1984	Radisson Hotel, La Crosse	Dr. K. S. Lubinski Ms. R. A. Schnick Dr. M. M. Smart
17th	1985	Radisson Hotel, La Crosse	Mr. R. C. Hubley Dr. J. G. Nickum Ms. P. A. Thiel
			<u>Board of Directors</u>
18th	1986	Radisson Hotel, La Crosse	Dr. J. W. Eckblad Dr. C. E. Korschgen Dr. J. H. Peck
19th	1987	Univ of Wisconsin-La Crosse	Mr. Hannibal Bolton Dr. L. E. Holland Mr. M. R. Winfrey
20th	1988	Univ of Wisconsin-La Crosse	Dr. John Pitlo Dr. Verdel Dawson Dr. Nani Bhowmik

SUMMARY - MINUTES OF THE 20TH MEETING OF THE MISSISSIPPI RIVER  
RESEARCH CONSORTIUM, INC.

April 8, 1988

Unanimous approval of the minutes from the 1987 MRCC meeting

1. Announcements

- a. Sale of Contaminants in the Upper Mississippi River at registration desk.
- b. Hydrolab demonstration will be at 1:30 at the National Fisheries Research Center.

2. Financial Status of the MRRC

Assests

\$ 2,741.91	Beginning Balance (May 1987)
2,217.50	Preregistration
500.00	On-site registration
320.00	Contaminant Book Sales (64)
<u>15.48</u>	Royalties
\$ 5,794.89	

Liabilities

595.00	Banquet
635.00	Facilities, entertainment, and DJ
57.00	Parking Permits
79.66	Programs
266.98	Postage
1,341.28	Contaminants Book Purchase
31.00	Corporation Fee
<u>133.36</u>	Miscellaneous
\$ 2,655.61	Balance on Hand (May 1988)

3. By-Law Changes

None

4. Membership Dues and Mailing List

Mailing list was updated. Dues are \$5.00

5. Old Business

The Executive Committee wrote a letter to the river Congressman in support of the budget for the EMP in 1987. The vote was unanimous to have the Executive Committee do this again in 1988.

The UMRCC meeting date is set for March 7-9, 1989. There was a

discussion to have a joint meeting with UMRCC. The meeting shall be held in La Crosse. The Directors will handle whether a joint or back-to-back meeting will be held with UMRCC.

6. New Business

Gail Carmody, UMRCC Coordinator, explained the UMRCC library. She encouraged people to send new publications to the library. Gail discussed the abundance and disadvantages of gray literature and suggested the concept of a regional journal. Marion Havlik suggested using the abstracts from our meetings to be published as a volume so they could be cited.

Leslie Holland-Bartels strongly agrees with Gail that there should be a thorough investigation on the development of a working group to develop a regional journal. Leslie moved that a working group should be developed from the MRRC to look into the possibility of a regional journal. It was seconded. Jim Weiner suggested that a lot of space be allotted to data tables in a new journal. Motion was passed.

Volunteers for working committee: Leslie Holland-Bartels, Ken Lubinski, Dave Kennedy, A.R. Weisbrod, John Ramsey, John Wetzel, Gail Carmody, Nani Bhowmik, M.A. Romano, Mike Dewey, and Pam Theil.

John Pitlo has been approached to hold a special meeting within the annual meeting on the following: Costeau Society has hired Odum to develop an energy model. There has been a suggestion to have a discussion or panel on this next year. The new Directors should look into doing this at the next meeting.

7. Nomination and Election of Board of Directors

Names placed in nomination:

Dr. Larry Jahn, Western Illinois University  
Jerry Rasmussen, Fish and Wildlife Service  
Dr. Bill LeGrand, University of Wisconsin-Stevens Point

Membership voted unanimously in favor of the new slate of Board of Directors.

8. Acknowledgements

Special acknowledgement to Janet Beitlich, Fish Disease Control Center, Diane Wolfe, LTRM, Barbara Deml, National Fisheries Research Center for the mailing list, newsletter and program. Acknowledgement to Verdel Dawson, Program Moderators, AV assistants, and exhibits committee.

End of business meeting



ABSTRACTS FOR TECHNICAL PAPERS

Thursday and Friday

27 - 28 April 1989

Abstracts are listed in the order of presentation

POSTER ONLY

WATERFOWL NESTING ISLANDS IN A MISSISSIPPI BACKWATER: AN EXPERIMENT IN PROGRESS. K. M. Cheap, U. S. Fish and Wildlife Service, Upper Mississippi River National Wildlife and Fish Refuge, 51 E. 4th St., Room 100, Winona, MN 55987.

In 1987 as part of the Weaver Bottoms Rehabilitation Project, two islands were created in a 4,000 acre backwater in Pool 5 of the Mississippi River. These islands provided the opportunity to study the vegetative colonization of large river islands and their subsequent use by waterfowl for nesting. Dredge spoil from routine navigation channel maintenance was used to create the 10- and 15- acre islands. The above-water surfaces of the islands were topped with a layer of fine sediment material which was dredged from the surrounding area. In 1988, this organic layer was mixed with the dredge spoil to create a soil base for vegetation. On one of the islands native grasses were seeded to provide nesting cover and stabilize the surface during floods. The shoreline of this island was also planted with emergent aquatic vegetation to control erosion and provide additional habitat. The other island was left to natural vegetative colonization. Monitoring of the vegetation and waterfowl nesting on both islands will be conducted annually starting in 1989.

POSTER ONLY

WATER QUALITY CONDITIONS OF UPPER MISSISSIPPI RIVER SYSTEM HABITATS DURING A DROUGHT. Lubinski, K. S., R. V. Anderson, G. L. Benjamin, R. D. Gent, J. W. Grubaugh, D. B. Markillie, and S. M. Schellhaass. USFWS/EMTC, 575 Lester Dr., Onalaska, WI 54650.

A drought impacted the Upper Mississippi River System watershed in 1988, resulting in low river discharges and water elevations. Long Term Resource Monitoring Program (LTRMP) surface water quality data collected weekly between July and October in pools 8, 13 and 26 were analysed to document spatial and temporal patterns among five habitat types. Habitat categories included, in increasing order of water retention time: channel border wingdam (CB-W); channel border-unstructured (CB-U); impounded (IMP) backwater-contiguous; and backwater-isolated. Gradual, decreasing water temperature gradients existed from channel to backwater habitats during autumn, presumably due to differences in rate of heat loss. Dissolved oxygen concentrations below 5 mg/l occurred more frequently in downstream pools and backwater habitats. Turbidity levels (NTU's) of channel habitats were surprisingly similar among pools. In pools 13 and 26, turbidity levels were unexpectedly higher in backwater habitats than channel habitats, possibly due to high plankton densities, or disturbance of substrates by wind or fish. Specific conductance increased in the downstream direction. Overall, water quality conditions were more heterogenous and unpredictable in habitats most isolated from the main river flow. The data have become a part of the permanent record being established under the LTRMP, and therefore will enable future comparisons to conditions that exist during moderate- or high-flow years.

ENERGY SYSTEMS OVERVIEW OF THE MISSISSIPPI RIVER BASIN. H. T. Odum, Department of Environmental Engineering Sciences, University of Florida, Gainesville, FL 32611. C. D. Diamond, Joint Center for Urban and Problems, Florida Atlantic University, Boca Raton, FL 33431, M. T. Brown, Center for Wetlands, University of Florida, Gainesville, FL 32611, and R. C. Murphy, The Cousteau Society, 8430 Santa Monica Blvd, Los Angeles, CA 90069.

An energy systems overview was developed for the Mississippi Basin of the United States. New methods of analysis were used to evaluate environmental bases of the economy and to consider alternatives, trends, and policies. Solar EMERGY, a natural measure of value, was used to determine contributions of environmental work and human work to the economy on the same basis, namely the equivalent solar energy required. Contributions of each item to the economy were estimated using the percentage its solar EMERGY was of the total solar EMERGY of the system (expressed in economic value). The Energy overview suggests: 1. The main bases for the economy are flows of oil and gas, rain and rivers, and outside goods and services. A large value is in the sediments eroded from farmlands and washed to the sea unused. 2. The solar EMERGY transformed per unit of water energy (transformity) measures the value of concentrating water into larger streams. As a measure of complexity, information contents of the river network were found and related to the system of energy flow which maintains the systems. 3. Tables of EMERGY flow were developed to consider public policy alternatives for the Basin. Very large values in wetland service, in sediment deposition, and in water control were diverted into the sea by diking and channelizing. Although large savings were obtained for transportation, especially for fuel transport, they were less than previous river values unnecessarily diverted. High values justify measures for restoring wetlands and their contributions. 4. A microcomputer simulation model was developed using the data for the aggregated overview of the Basin economy. Declining fuel reserves caused a maximum in the economy, followed by gradual decline.

DEVELOPMENT OF A GEOGRAPHIC INFORMATION SYSTEM DATA BASE AS A MANAGEMENT TOOL FOR A BIOLOGICALLY UNIQUE RIVER BASIN. C. J. O'Bara, A.G. Bailey, Y. Robinet-Clark. Center for the Management, Utilization, and Protection of Water Resources, Tennessee Technological University, Cookeville, TN 38505.

A geographic information system data base was developed for the Clinch and Powell river basins (Tennessee River system) to serve as an information source and management tool. The data base consisted of related cartographic and textual files. The cartographic component included 13 coverages which included stream networks, watershed boundaries, transportation routes, elevation, landuse, chemical and biological sampling locations, as well as regulated discharge points. Textual files provided information concerned with water quality, water quantity, biotic integrity, and other hydrologic related attributes. All cartographic and textual files were linked to a specific river reach through a unique identifier. The data base was developed using the ARC/INFO software. The procedures used during the data base development are considered generic for all GIS based endeavors. These procedures included identifying informational needs, locating and processing available data, and integrating all data into a coherent data base. Through these procedures, the data base was developed to enable resource managers to determine potentially degrading activities, to identify data collection requirements, and to gain a better understanding of the terrestrial and aquatic interactions within these basins.

POOL 26 WATER CHEMISTRY: THE FIRST YEAR OF LTRM. R. V. Anderson, J. W. Grubaugh, D. B. Markillie and F. A. Cronin. Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

In 1988 over 2500 water chemistry samples were collected at 17 locations including channel border and backwater habitats in Pool 26 of the Mississippi River and lower Illinois River. Weekly samples for dissolved oxygen, temperature, Secchi disk transparency, nephelometric turbidity, specific conductivity, and velocity were collected at these sites. The Illinois River had higher conductivity and turbidity and lower transparency than other sites and influenced the water quality of the Mississippi River below its confluence. Of the habitat types sampled, isolated backwaters were consistently the most distinct, not surprising since it has the least interface with the other habitats particularly in this year of low flows. The drought conditions in the Mississippi River drainage resulted in extremely stable low flows throughout the study period. Consequently differences between study reaches and habitats were not as large as might be expected.

PADDLEFISH MOVEMENTS AND HABITAT USE IN POOL 13 OF THE UPPER MISSISSIPPI RIVER DURING A DROUGHT YEAR. C. T. Moen, D. L. Scarnecchia, and J. S. Ramsey, Department of Animal Ecology and Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University, Ames, IA 50011.

During spring and summer 1988, radio transmitters with an expected battery life of 2.5+ years were surgically implanted in 35 paddlefish (Polyodon spathula) in Pool 13 of the Upper Mississippi River. Fish locations were intensely monitored during late March through May in an attempt to locate and describe spawning areas. Because of abnormally low spring runoff, the gates were not opened and tagged fish were unable to pass upstream through Lock and Dam 12. Sampling for paddlefish eggs and larvae in likely spawning and rearing areas was unsuccessful. During the period from May to August 1988, the habitat variables of water surface temperature, general substrate type, and water velocity (at 30.5 cm below the surface, at 0.6 x depth, and at 30.5 cm from bottom) were measured at 57 paddlefish locations. For the year, 33 tagged paddlefish were located and general habitat type identified 812 times. Paddlefish movements and habitat use in 1988 are presented and compared with the results of a 1980/1981 paddlefish radio telemetry study conducted in Pool 13 during higher water levels.

RATIONALE FOR A HARVEST SLOT LIMIT FOR PADDLEFISH (POLYODON SPATHULA) ON THE UPPER MISSISSIPPI RIVER. Dennis L. Scarnecchia, Department of Animal Ecology, Iowa State University, Ames, IA 50011; Thomas W. Gengerke, Iowa Department of Natural Resources, Box 7222, Spirit Lake, and Clark T. Moen, Department of Animal Ecology and Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University, 50011.

Data are reviewed on lengths, weights, and sex of paddlefish (Polyodon spathula) captured by snagging and by nets from Pool 13, Upper-Mississippi River in 1975-78 and 1988. From 1975 to 1978, only seven of 315 male fish (2.2%) exceeded 114 cm (45 in) fork length, whereas 41 of the 288 females (14.2%) exceeded that length. Only two males (0.6%) exceeded 11 years of age, whereas 22 females (7.6%) exceed age 11. Among fish exceeding 114 cm, there were thus 5.9 females harvested for every male, a highly significant difference between the sexes ( $P < 0.005$ ). Of the 33 fish sampled in 1988 that exceeded 114 cm fork length, 28 were females and 5 were males, or 5.6 females for every male. On the basis of these results and other supporting evidence, a harvest slot limit of 57-86 cm body length (front of eye to fork of tail or 22-34 in) or 2.2-11.3 kg (5-25 lb) weight is proposed for paddlefish in Iowa's portion of the Mississippi River. Fish larger or smaller than these limits would be protected from harvest. Management considerations include public acceptance of the regulation, hooking and handling mortality, the need for enforcement and evaluation, and coordination among states.

HABITAT USE BY SHOVELNOSE STURGEON IN POOL 13, UPPER MISSISSIPPI RIVER, DURING EXTREME LOW FLOW. G. L. Curtis, J.S. Ramsey and D.L. Scarnecchia, Iowa Cooperative Fish and Wildlife Research Unit and Department of Animal Ecology, Iowa State University, Ames, IA 50011.

The movements of 28 radio-tagged shovelnose sturgeon (Scaphirhynchus platorvncus) were monitored in Pool 13, upper Mississippi River at Bellevue, IA, between 15 April and 25 August 1988. General habitat types frequented were recorded for 217 telemetry fixes. Specific habitat (depth, water temperature, substrate, and current at surface, midwater and bottom) was performed for sightings. Most sturgeon position fixes (48.8%) were in main channel habitat during the extreme low flow observed in 1988, in sharp contrast to the results of a 1982 study conducted during normal flow. Other low-flow-sightings were in main-channel border wingdam fields (30.0%) and upper tailwater (15.2%). Fewer were in open main-channel border (4.6%) and side channel habitat (1.0%). The fish tended to scatter widely in the upper part of Pool 13 but apparently were unable to move above Lock and Dam 12. We detected neither specific movement patterns nor strong tendencies for sturgeon to congregate. Data analysis on habitat selection or avoidance continues.

MUSSELS OF POOL 19, 75 YEARS BEHIND A DAM. R. V. Anderson, J. W. Grubaugh, R. E. Sparks, and K. W. Blodgett. Department of Biological Sciences, Western Illinois, Macomb, IL 61455.

The river reach presently designated Pool 19 has long been an area of known mussel beds with history notes dating to the early 19th century. In association with commercial harvest for the pearl button industry and of Dam 19 early researchers predicted a reduction in the mussel populations of the river. Qualitative construction and quantitative records for the past 75 years were examined to determine if changes have occurred and to evaluate those changes in the mussel community. While commercial mussel harvest rapidly declined in the 30s and 40s it has again become a prevalent activity on the river with tons of mussels being removed from the river annually. In 1930, 21 species of mussels were collected from this Pool while in the mid-1980's 29 species were present. Sampling effort and the number of habitats examined increased in the 1980's. Even though simple diversity may have increased density has decreased. Though more species are presently reported from this river reach, shifts in density and composition have occurred with previously abundant species becoming rare.

DENSITY, DIVERSITY AND SIZE/AGE VARIATION IN MUSSEL BEDS IN THE UPPER MISSISSIPPI RIVER. E. T. Cawley, Department of Biology, Loras College, Dubuque Iowa 52001.

Ten Mussel beds were sampled using surface supplied diving during the summer of 1988. The locations ranged from Montrose, Iowa to Lansing, Iowa, a distance of 290 river miles. Sampling consisted of 396 quarter meter quadrats. Total bottom samples were collected, sieved and handpicked on the surface. Mussels as small as 6 mm. were obtained. twenty eight species were identified. A total of 5404 mussels were collected, identified and measured. Densities varied from a low of one per square meter to a high of 389 per square meter. Populations were highly aggregated in all the beds. Species distribution and bed diversity will be compared in each of the sites. The age and/or size distribution of the ten most abundant species, including Amblema plicata, Megaloniais gigantea, Quadrula quadrula, Leptodea fragilis and Truncilla truncata will be compared. There is a need for periodic resampling of beds to define age/size cohorts to use in the interpretation of population dynamics of mussels. This information is necessary to make intelligent management decisions in regard to the resource.

SHORELINE COLLECTIONS OF NAIAD MOLLUSKS (UNIONIDAE), LOWER ST. CROIX RIVER: NORTHERN STATES POWER DAM, ST. CROIX FALLS, WI, TO NEAR STILLWATER, MN. Marian E. Havlik, and James A. Frink, Wisconsin Department of Natural Resources, Box 7921, Madison, WI 53707.

A 1985 chance discovery of shells at the MN Interstate Park, Taylors Falls, indicated a diverse mussel fauna in the St. Croix River. This was confirmed by a brief survey by Malacological Consultants, August 1986. In June 1987 a shoreline/shallow water collection was conducted by the WDNR from the Northern States Power Company (NSP) dam, St. Croix Falls, WI, to 4 mi upstream of Stillwater, MN. Objectives were to determine the unionids in that portion of the St. Croix, and to identify areas for future quantitative studies. NSP cooperation enabled collecting between the NSP dam and the Hwy 8 bridge. Sixty-one additional sites were randomly selected, mostly by the presence of shells on the shoreline, as crew of 4 proceeded downriver. 35 species were found: 32 living, 2 represented by fresh-dead shells, and 1 represented by sub-fossil shells. Living species documenting recent UMR, states, and river records included Lampsilis higginsii (33 mile range extension), Lasmigona Costata, Quadrula quadrula, Q. fragosa, Q. metanevra, Cycloniais tuberculata, Elliptio crassidens, Ellipsaria lineolata, and Epioblasma triquetra. Recent records for several species, including Cumberlandia monodonta and Simpsoniais ambigua, were represented by fresh shells, but only sub-fossil Fusconaia ebena was found. We found no trace of Plethobasus cyphus (Dawley 1947). Truncilla truncata is dominant at the Parks; the large river form of Fusconaia flava is dominant until Stillwater where Amblema plicata becomes dominant. This suggests different habitats, and different fish patterns. Many areas are vulnerable to human impacts (canoeists, fishermen, and persons looking for a food source). Since the river is protected, pollution does not seem to be a great problem, however not all species are doing well. Corbicula was not found above Stillwater.

EFFECTS OF A LOW-HEAD DAM REPLACEMENT ON A NAIAD MOLLUSK POPULATION (UNIONIDAE), STEEL DAM, ROCK RIVER, MILAN, IL. Marian E. Havlik, and James A. Frink, Malacological Consultants, 1603 Mississippi St., La Crosse, WI 54601.

A salvage survey for unionids, particularly Lampsilis higginsii, was conducted May 1988, before and after the construction of a cofferdam in the S channel, Rock River, Rock Island County, Milan, IL, prior to the completion of a replacement low-head dam. Immediate effects of construction were drastic; these effects must be considered in future dam replacements. Only 6 living unionids were found in 968 m<sup>2</sup> of the lower leg of the cofferdam, compared to 6 to 21/m<sup>2</sup> in the N portion of the channel, Sept. 1987. A field decision was made to determine how far downstream the unionid population had been affected, utilizing mostly 4 - 1/4 m<sup>2</sup> samples every 3 m on 35 m transects. No living naiades were found at 64, 96, and 128 m W of Steel Dam. At 160 m W living naiades were found. At the 224 m W transect normal naiad populations appeared (densities up to 22/1/4 m<sup>2</sup>). Divers recovered 38 species: 21 living (1141 specimens), 3 represented by fresh shells, and 14 represented by sub-fossil shells (5349 specimens). Obovaria olivaria greatly resembled L. higginsii (9 sub-fossil valves). River records included sub-fossil Potamilus capax (endangered), Cumberlandia monodonta, and Elliptio crassidens. Recent records included living Tritogonia verrucosa and Actinonaias 1. carinata. Species diversity has diminished by 33%, but there was no evidence of a die-off. There was reproduction in only a few species, probably more apparent than real due to sampling in predominantly cobble substrata. Corbicula fluminea not found. The shallow, one km river area between Steel Dam and Hwy 67 bridge deserves sanctuary status as 3 L. higginsii were found during 1988 low water levels (1 killed for fish-bait, 1 dying stranded on a gravel bar, and 1 returned to the river alive), and 16 Pleurobema sintoxis. 40 species have now been recorded from the Rock River, IL.



DISTRIBUTION AND RELATIVE ABUNDANCE OF FRESH WATER MUSSELS (NAIADACEA) IN THE SAINT CROIX NATIONAL SCENIC RIVERWAY. Thomas C. J. Doolittle, Cable Natural History Museum, Cable, Wisconsin 54812

Mussel distribution and relative abundance along the 250 mile (405 km) Saint Croix National Scenic Riverway were determined by sampling 84 regularly distributed sites. Sampling took place in the summer of 1987 and utilized SCUBA techniques. Each sample site encompassed 60 square meters of river bottom. An additional 36 midden pile sites were sampled as well. Thirty-eight species were found alive and two species were represented by dead shells only in the Saint Croix River. Sixteen species, all alive, were found in the Namekagon River. Anodontoides ferussianus was the only species restricted to the Namekagon River. Range extensions were documented for Cumberlandia monodonta, Simpsonaias ambigua, Quadrula fragrosa, Truncilla truncata, Epioblasma triquetra, Quadrula quadrula, Truncilla donaciformis, Tritigonia verrucosa, Quadrula metanevra; Lampsilis higginsii, Elliptio crassidens, and Ellipsaria lineolata. Mussel populations in the riverway were apparently healthy except for Quadrula fragrosa and Elliptio crassidens. Eight river stretches or sites were preliminarily identified as having significant mussel diversity or concentrations of rare species which merit special conservation attention. Clustered distribution of mussels was apparent throughout the riverway. Two species associations were apparent and included primarily common species or primarily uncommon species. Areas containing the highest species diversity also had the rarer species, but these areas were not necessarily areas of high mussel densities. Most (96.4%) mussels were collected at depths between 0.5m to 3.5m, this data being influenced by river levels. Over half (64.2%) of all mussels collected occurred in sand, gravel and rock bottom substrate of varying combinations.

RESULTS OF BASELINE SAMPLING OF FRESHWATER MUSSEL COMMUNITIES FOR LONG TERM MONITORING OF THE SAINT CROIX RIVER NATIONAL SCENIC RIVERWAY. David J. Heath, Wisconsin Department of Natural Resources, Madison, WI 53707

Based on 1987 survey results of the entire Saint Croix River National Scenic Riverway (Doolittle, 1988), four freshwater mussel long term monitoring areas were chosen in the Namekagon and St. Croix Rivers. The riverway contains some of the rarest mussel taxa in North America including Lampsilis higginsii, Cumberlandia monodonta, Quadrula fragrosa, and Simpsonaias ambigua. Quantitative and qualitative samples were taken using SCUBA diving from June through September, 1988. Quantitative samples were randomly chosen m<sup>2</sup> quadrat collections within which all living and dead mussels were collected, measured, externally aged and examined for presence of larvae. These data were used to determine population densities, age and length population structures, associations with subjectively determined current and substrate types and taxa associates. Non-quadrat collections were made to supplement quadrat samples where needed and were used for relative abundance and population age and length structures. Monitoring will be done on a ten year cycle and criteria will include presence or absence of taxa, comparison of population and community densities, population age and length structures, growth rates, relative abundance and comparison of proportion of each taxa gravid.

THE EFFECTS OF COMMERCIAL TRAFFIC ON FRESHWATER MUSSELS: BASELINE STUDIES. Andrew C. Miller and Barry S. Payne, US Army Engineer Waterways Experiment Station, Vicksburg, MS 39181-0631; and Dan Hornbach, Macalester College, St. Paul, MN 55105.

Studies on freshwater mussels (Mollusca:Unionidae) at productive beds in the upper Mississippi River were initiated by the US Army Engineer District, St. Louis. In 1987-88 a total of 667 incremental qualitative samples were obtained between RM 233 and 708, and 10-30 quantitative (0.25 sq m) samples were collected at RM 299.6, 389.5, 409.5, 433.3, 450.4, 504.7, and 635.0. Subsequent intensive sampling (1989-94) will be conducted at a minimum of four beds to determine the effects of commercial navigation traffic on density, relative species abundance, species richness, size demography of dominant species, physical condition, and presence of the endangered Lampsilis higginsii. Cumulative species was related to the logarithm of cumulative individuals; there were no substantial differences in this relationship with respect to RM or sampling technique (qualitative vs. quantitative). There were significant differences in total biomass, and substantial differences in relative species abundance between nearshore (with comparatively finer sediments, shallower depths, and reduced water velocity) and offshore sites. Anodonta imbecillis and Truncilla truncata were more abundant at nearshore than at offshore sites, whereas Obovaria olivaria exhibited the reverse trend. Total density was significantly higher at four nearshore sites (44.0 ±11.2 to 333.2 ± 215.8(±SD) individuals/sq m) than at four offshore sites (23.6 ±12.7 to 137.2 ±50.6 individuals/sq m, F = 14.24, P = 0.0001). The number of quantitative samples required to estimate total density at a 0.95 confidence limit with 10 and 20% error ranged from 26-248 and 6-62, respectively. No specific trends in shell morphometrics (shell mass vs. shell length and tissue dry mass vs. shell length) were apparent with respect to RM.



MUSSELS ON A FAST TRACK. J. L. Owens, R. V. Anderson and J. W. Grubaugh. Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

In Pools of the UMR between 60 and 90% of the permanent aquatic habitat is channel border. Mussels are found throughout this habitat but at low densities. These low density populations may serve as sources for recruitment into the denser mussel beds located in other areas of the river. This would require some means of movement or transport from the channel border habitat to the other areas. To test this hypothesis, direction and rate of mussel movement was examined in a channel border at RM 374 using a grid-plot sampling technique. Of the 11 species examined, all moved, several individuals moving in excess of 10 m in less than 6 months. Thin shelled species, such as Anodonta grandis, while often moving long distances, did not exhibit a directional preference. Thick shelled species, Amblema olicata and Quadrula quadrula, by contrast moved down stream and toward the channel. Since thick shelled species are typically found in "mussel beds" directional movement may be a relocating mechanism resulting in maintenance of high density, reproductive populations in some river reaches.

CULTURE OF FRESHWATER MUSSELS: PROSPECTS FOR SUCCESS Steve J. Zigler, Leslie Holland-Bartels and Diane L. Waller, National Fisheries Research Center, P.O. Box 818, La Crosse, Wisconsin 54601

Because of successes in the culture of some marine bivalves, artificial propagation has been suggested as a means to rejuvenate populations of many species of endangered freshwater mussels. However, significant difficulties exist that are not clearly reflected in the existing literature on the subject. Over the last 5 years we have developed methods for laboratory production of recently metamorphosed juveniles of several species in the genus Lampsilis and, in the last 3 years, have concentrated on development of approaches for extended culture of juveniles. To date we have succeeded in culturing juveniles up to 77 days with 7 week survival as great as 78% and growth up to 1.04 mm (4.5 times size at metamorphosis). Although best culture has occurred in a static system, with a phytoplankton food source, and in the presence of silt, significant inconsistencies exist between treatment replicates that confound conclusions. The importance of food type, the function of food delivery to these microscopic organisms, the role of predators and juvenile mussel viability are questions for which there appear no quick answers.

PRE AND POSTCONSTRUCTION FIELD STUDIES: PARTIAL CLOSURE OF ACKERMAN'S CUT NEAR RM 614, MISSISSIPPI RIVER. Tatsuaki Nakato, Iowa Institute of Hydraulic Research, The University of Iowa, Iowa City, Iowa, 52242, and Keiichi Toda, NEW JEC, Shimanouchi, Minami-Ku, Osaka, Japan.

Ackerman's Cut (AC), located about 1.4 miles downstream from L&D 10 in Guttenberg, Iowa, was partially closed by the U.S. Army Corps of Engineers (COE), Rock Island District, during the summer of 1985. The primary purpose of the structure was to increase the sediment transport capacity of the main channel of the Mississippi River (MR) by increasing the flow rate in the downstream navigation channel, and at the same time to protect the fishery resources of Cassville Slough (CS) by reducing sediment inflow into the slough. Prior to construction of two submerged dikes, the AC channel bed had been degraded considerably, and more than 30% of the total MR was found to pass into CS. Preconstruction bathymetric survey surrounding AC was conducted by Iowa Institute of Hydraulic Research (IIHR) in June 1983, and postconstruction survey was done in November 1985. During these field investigations, detailed bathymetric data as well as velocities, suspended-sediment concentrations, bed-material size distributions were acquired. Because river geomorphic changes after construction of such flow-control structures generally require a much longer time period than the one used (only several months) in responding to the new configuration, there were no substantial postconstruction changes observed in either the cross-section profiles or the bed-material compositions of the study reach in the MR and CS. Curves to predict head drops across AC were also developed during the study as functions of a bifurcation factor, a total MR discharge, and Manning's coefficients.

MEASUREMENT OF VELOCITY, DRAWDOWN, AND SUSPENDED SEDIMENTS DURING BARGE TOW PASSAGE. N. G. Bhowmik and J. R. Adams, Surface Water Section, Illinois State Water Survey, 2204 Griffith Drive, Champaign, IL 61820-7495.

Instruments and data logging methods are described for water velocity, river stage, drawdown, and suspended sediment measurements adjacent to the navigation channel. Velocity measurements are obtained using two types of electromagnetic meters. The S4 oceanographic instrument is designed for remote and long-term deployment with onboard data logging capabilities. The S4 meter measures two components of velocity, meter azimuth from north, and water depth/pressure. Sampling and recording frequency can be two readings per second, which allows a 2-hour deployment before the data must be downloaded and the logger reprogrammed. Plans for multiple velocity measurements in a single vertical are described. Marsh-McBirney 511 two-dimensional meters will be used for this and an automatic data logging system will be used with these instruments also.

Drawdown is measured in two ways: 1) from the S4 pressure records, and 2) from video records of a staff gage near shore. This actually gives drawdown measurements at two/three distances from the sailing line

Suspended sediment samples are collected at 1-minute intervals from intakes at 1 and 2 feet above the river bed by means of ISCO pumping samplers and manual filling of sample bottles. Example of instrument placement and data are presented from a field data collection effort near McEvers Island at mile 50 on the Illinois River.

CONCEPTUAL INVESTIGATIONS OF THE IMPACTS OF RECREATIONAL TRAFFIC ON THE UMRS. N. G. Bhowmik, J. R. Adams, M. Demissie, Surface Water Section, Illinois State Water Survey, 2204 Griffith Drive, Champaign, IL 61820.

Recreational traffic in any waterway will generate waves and can resuspend bed materials depending upon the proximity of the traffic to the shoreline and the bed of the waterway. Recreational traffic includes fishing boats, houseboats, runabouts, and cruisers. These boats can run from trolling speed to 30 or 40 miles per hour. Depending upon the availability of marinas and proximity of populated areas, the frequency of passage of recreational boats can be quite high. A review of available literature indicated that very little information is available on the impacts of recreational traffic on the UMRS. It is recommended that a generalized investigation of recreational traffic be made to determine the impacts of this phenomena on the UMRS. This presentation will outline such an investigation with possible scenarios and experimental setups with the hope that the participants in this conference will contribute their concepts and ideas to this important topic.

THE RELATIONSHIPS AMONG THE RATE OF SEDIMENT ACCUMULATION, TRAP SIZE AND RIVER STAGE IN A BACKWATER, LAKE, POOL 2, MISSISSIPPI RIVER. Tony Deneka, Daniel J. Hornbach, Dept. Biology, Macalester College, St. Paul, MN 55105; Andrew C. Miller and Barry S. Payne, U.S. Army Engineer, Waterways Experiment Station, Vicksburg, MS 39180.

The factors affecting sediment deposition in a backwater lake were examined in the summers of 1987 and 1988 in River Lake (RM 826). In 1987, sedimentation rates were measured using PVC tubes (height:diameter ratio 10:1=15":1.5"). Nine replicates were placed at each of 3 stations along each of 3 N/S transects of the lake for 2 week periods. These transects were parallel to the flow of the river with Transect A closest to input from the river and Transect C farthest from the direct effects of river inputs. For 1988, the sampling regimen was expanded to include 5:1 (6:1.5") (for 18 of 20 weeks) and 2:1 (6:3") traps (for 6 of 20 weeks) at the same stations to test for possible resuspension effects. The total weight and ash-free dry weight of the accumulated sediment was measured for six of the nine traps and the volume of sediment was assessed for the remaining three traps. Significant differences were found among transects in the rates of deposition as dry mass (A>B>C) and in the percent organic matter (C>B>A). These relationships appear to be due to the locations of the transects relative to the main river channel and backwater inlets. Analyses indicate that for the 10:1 traps, sedimentation is positively correlated to the total suspended solids (TSS) and is negatively correlated to the mean and maximum river discharge and the percent organic matter in the TSS. Both the 5:1 and the 2:1 trap data manifest the same general correlations. This would seem to indicate a general negative correlation between sedimentation rates in the backwater and main channel flow. When examined over the period for which there is complete data, trap size had a significant effect upon the dry and ash-free dry mass rates of sedimentation (5:1>10:1>2:1) and percent organic matter (10:1>2:1>5:1). These differences are likely due to the resuspension of sediments in the 2:1 traps and the differences in the proportion of the water sampled by the 5:1 and 10:1 traps.

THE RELATIONSHIP BETWEEN THE RATE OF SEDIMENT ACCUMULATION AND THE DENSITY AND DIVERSITY OF MIDGE LARVAE IN A BACKWATER LAKE OF POOL 2, MISSISSIPPI RIVER. D. J. Hornbach, Tony Deneka, Dept. Biology, Macalester College, St. Paul, MN 55105, Andrew C. Miller and Barry S. Payne, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS 39180.

The relationship between sedimentation and midge community structure was examined in River Lake (RM 826) in the summers of 1987 and 1988. Three North/South transects with 3 stations Per transect were established parallel to the flow of the river. Transect A was closest to the river and Transect C was farthest. Nine 1.5" dia., 15" high PVC tubes were placed at each station and retrieved every 2 weeks to estimate sedimentation. The dry weight (dw) and ash-free dry weight of the accumulated sediment was measured. Midge densities were estimated by taking 3 replicate 3" diameter cores at each station every 2 weeks. Transect A had the highest rates of sediment deposition (52 mg dw/cm<sup>2</sup>/day) and lowest percent organic matter (9.3%) while transect C had the lowest rates (35 mg dw/cm<sup>2</sup>/day) and highest organic matter (12.6%). There were 3 dominant species of midges Chironomus, Cryptochironomus and Pentaneura averaging 41, 36 and 22% of the total number of midges in each sample respectively. Chironomus larvae made up a greater proportion of the midge community in transect A (47%) and less in transect C (26%). Significant negative correlations were found among the relative abundance of Chironomus and the other midge species. There were statistically significant negative correlations between the overall mean density and the rates of sedimentation and the percent organic matter. Total midge density was highest in transects A and B and lowest in transect C. For the three dominant species of midges, the average size of the larvae differed with the largest from transect B and the smallest from transect C. These differences are statistically significant for Chironomus and Pentaneura but not for Cryptochironomus. This study suggests that there is a relationship among the rates of sedimentation and midge community structure. Whether this relationship is causal or merely due to similar correlations to an unexamined factor is uncertain.

PRODUCTION OF LARVAL MIDGES AND CADDISFLIES ON LOWER MISSISSIPPI RIVER DIKES. Barry S. Payne, C. Rex Bingham, Andrew C. Miller, and Stephen P. Cobb, Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, P.O. Box 631, Vicksburg, MS 39180 and Lower Mississippi River Division, U.S. Army Engineers, Vicksburg, MS 39180.

Samples of macroinvertebrates were removed monthly from stones that comprise training dikes in the lower Mississippi River (RM 510-515) from September to November, 1987 and May to December, 1988. The midge Rheotanytarsus sp. and the caddisfly Hydropsyche orris were the dominant larval insects among the stone epifauna. Developmental synchrony was high among individuals in both populations. Seasonal changes in instar relative abundance indicated trivoltine and bivoltine life cycles for Rheotanytarsus sp. and H. orris, respectively. Cohort production-to-average standing crop (P/B) ratios were estimated for each population based on life cycle, density, and individual dry weight data. The spring, summer, and fall cohorts of Rheotanytarsus sp. had P/B ratios of 3.0, 3.0, and 2.7, respectively. The spring and late summer cohorts of H. orris had P/B ratios of 4.1 and 4.0. These values closely match those in published studies for other midge and hydropsychid caddisfly populations. Interspecific differences in P/B ratios reflected differences in instantaneous growth rate (G); estimates of G equaled 6 and 160 for Rheotanytarsus sp. and H. orris, respectively. Annual production of Rheotanytarsus sp. was 1.4 g (dry weight)/m<sup>2</sup>. This result represents the first population production estimate for this midge that is commonly abundant on hard substrates exposed to swift river currents. Annual production of the H. orris population was 10.1 g/m<sup>2</sup>, a value that closely matches the average value of 12.6 g/m<sup>2</sup> based on nine published accounts of highly productive lotic hydropsychid populations inhabiting natural cobble and snag substrates. Stone dikes are an important source of stable coarse-grained substrate in the lower Mississippi River and support naturally high production of rheophilic epifaunal species such Rheotanytarsus sp. and H. orris.

A PRELIMINARY EXAMINATION OF THE INFLUENCE OF CYPRINUS CARPIO L. ON BENTHIC MACROINVERTEBRATES OF RIVER LAKE. Thomas P. Wilcox, Daniel J. Hornbach, Dept. Biology, Macalester College St. Paul, MN 55105.

A preliminary examination of the influence of Cyprinus carpio L. on benthic communities in River Lake was conducted from June 14 - July 23, 1988. Six enclosures (225 m<sup>2</sup>) were erected. These stood for 2 weeks prior to stocking with C. carpio. three of the enclosures (I, II and III) were stocked with 30, 15, and 5 fish, respectively; while the other three remained as controls. Every 3 weeks six 3" cores were taken in each enclosure for assessment of benthic invertebrate communities; as well as two 1" cores for analysis of the percentage of organic matter in the sediment. The first sample set was obtained 1 day prior to the stocking; the others after stocking had taken place. In addition, sedimentation rates were estimated for the last 3 weeks using PVC tubes (6:1.5 inches). The three most abundant taxa were chironominae, oligochaeta, and heliedae. Previous to stocking no differences existed between experimental and control enclosure in oligochaeta, heliedae or total benthic densities (ANOVA,  $p > .05$ ). Chironomids show some difference between enclosure III and the controls ( $p < .05$ ). Following stocking, no significant effect can be seen by carp on chironomids ( $p > .05$ ) in all experimental enclosures. In enclosure I heliedae density appear lower ( $p < .05$ ); while in III, both helied and total invertebrate densities are significantly less than within the controls ( $p < .001$ ). Preliminary analysis of diversity indices indicates that lower  $H'$  values correlate with increased C. carpio densities. Organic content in the sediment previous to stocking did not vary significantly between enclosures. Consequent to stocking there appears to be a trend towards lower organic content, but a significant difference was found only between enclosure II and the controls ( $p < .05$ ). Sedimentation rates differed significantly between enclosure I and III and the control enclosures, and inversely to carp density; enclosure I showing the greatest difference ( $p < .001$ ), enclosure II the second ( $p < .01$ ), with enclosure III similar to the controls ( $P > .1$ ). These data indicate that C. carpio has some effect upon benthic community structure and dynamics, as well as the physical environment in which these communities reside.

LIFE OF A LOTUS EATER. J. L. Arnold and R. V. Anderson, Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

Few animal grazers depend solely on aquatic macrophytes as a food source. A notable exception is the Lotus Borer, Ostrinia penitalis, which feeds exclusively on American Lotus, Nelumbo lutea. The distribution and coverage of this macrophyte is expanding in the upper Mississippi River. During 1988, the life cycle of the Lotus Borer was studied in a macrophyte bed located at RM 374. Adults and early instar larvae first appeared in late May however, peak populations did not occur until mid to late August. Several cohorts were present in mid and late summer indicating a multivoltine reproductive pattern. Insect densities were directly correlated to the physiognomy of the American Lotus. The insect can cause substantial damage to the plants effecting overall primary production of the macrophyte bed particularly seed production.

IMPLICATIONS OF MACROPHYTE BED DEVELOPMENT IN A MAIN-CHANNEL BORDER AREA, UPPER MISSISSIPPI RIVER. P. P. Tazik, R. V. Anderson. Illinois Natural History Survey, 607 Peabody Dr., Champaign, IL 61820 and Dept. Biological Sciences, Western Illinois University, Macomb, IL 61455.

The Upper Mississippi River has been modified by a series of locks and dams that impound water. The first of the 26 artificial impoundments was created in 1913 by the construction of Lock and Dam 19 at Keokuk, Iowa. This impoundment has served as a sediment trap and within 40 years bottom sediments reached the photic zone, allowing growth of aquatic vegetation. Since then, there have been dramatic changes in size and species composition of the aquatic vegetation beds in Pool 19. During 1986, the vegetation bed in the lower pool covered approximately 110 ha and included Nelumbo lutea, Vallisneria americana, Potamogeton pectinatus, and P. nodosus. N. lutea was not present in this plant bed prior to 1984 and V. americana has only recently become a dominant. Data indicated that floods of unusual magnitude or duration and drought have dramatic effects on macrophyte composition at this site. Floods may maintain or reverse succession by disturbing established plant populations. Reduced flows and water levels have favored first the spread of the plant bed then invasion by floating leaved, emergent plants.



VARIATIONS IN CAPTURE EFFICIENCY OF A SEINE IN RIVERINE HABITATS. M. R. Dewey and L.E. Holland-Bartels, U.S. Fish and Wildlife Service, National Fisheries Research Center, P.O. Box 818, LaCrosse, Wisconsin 54602.

The seine is one of the most common tools used in fishery science to view variations in densities of species and community composition among habitats. However, as in all sampling gears, the seine gives a biased estimate of the population. Few data exist in riverine systems to judge what impact gear bias has on our view of habitat value and species use of habitats. We examined the seasonal and diel variations in capture efficiency of a standard bag seine in two riverine habitats (vegetated and non vegetated) both from a total catch perspective and a species-specific perspective. Overall capture efficiency for total catch was 49%. However, differences ( $P \leq 0.05$ ) in capture efficiency values between day and night and a variety of significant interactions (date x time, habitat x time) make it difficult to correct the data for bias. Several species demonstrated noticeable differences in their susceptibility to the sampling gear which could potentially effect community composition estimates.

MICROHABITAT UTILIZATION OF A MAIN CHANNEL BORDER ISLAND COMPLEX BY YOUNG-OF-THE-YEAR-FISHES. Michael D. Schueller, L.E. Holland-Bartels and M.R. Dewey. NFRC LaCrosse, WI 54602

Young-of-the-year fishes in the main channel island environment of the upper Mississippi River were examined to determine critical biotic and abiotic factors which influence their distributions. A main channel island complex was selected for study because it offered a continuum of suspected microhabitat factors. Fish were collected from eight sites around Dakota Island, Pool 7 by bag seine on three consecutive days every other week from May through October, 1987. The microhabitat measurements taken included water quality (temperature, D.O., pH, conductivity, turbidity), vegetation characteristics (type, density, estimated percent cover), and current and depth profiles. Nearly 40,000 fish of 30 species were collected. Sites differed not only in total catch per unit effort based on analysis of variance, but also in community structure based on clustering methods. Stepwise discriminate analyses indicate, for example, that vegetation densities and estimated percent surface cover are the principle factors controlling the presence or absence of bluegill in the island environment. A model was generated that correctly predicted bluegill presence in 70% of the observations based on Vallisneria americana densities and estimated percent surface cover. These functions should be useful tools for predicting distributions of key species in other areas of the river.

INTRAMUCILAGINOUS DIATOM FLORAS OF THE COLONIAL CILIATE OPHRYDIUM VERSATILE FROM ITASCA STATE PARK, MINNESOTA. D. B. Czarnecki, Department of Biology, Loras College, Dubuque, IA 52004-0178 and Itasca Biology Program, University of Minnesota, Minneapolis, MN 55455.

The composition and structure of diatom assemblages occurring intramucilaginosly within colonies of the ciliate Ophrydium versatile collected from Lake Itasca State Park, Minnesota were determined. Sixty-seven diatom taxa were encountered, all but six being restricted to one or more habitat locations. Assemblages were strongly dominated by species of Cymbella and especially by Nitzschia. Colony size and substratum had no apparent influence on assemblage characteristics. Nitzschia flexoides Geitler appears to be an obligate intramucilaginous inhabitant of Ophrydium from one location, and Cymbella cesatii (Rabh.) Grun. ex V. H. appears to be a coincidental intramucilaginous inhabitant from another; both taxa have been regarded previously as obligate coinhabitants of Ophrydium mucilage.

A TICK ATTACK II: MORE LYME DISEASE ON THE SAINT CROIX RIVER. A. R. Weisbrod Saint Croix National Riverway, Spring Creek Field Laboratory, P.O. Box 168, Marine On St. Croix, MN 55047.

Saint Croix National Riverway forms a 400 km long north south transect across the known Lyme disease distribution in the Upper Mississippi River Valley. A study of fragmented riparian habitat use by long distance migrating birds along the Saint Croix River from 1984 - 87 resulted in the discovery that birds serve as host to deer ticks, Ixodes dammini, the Lyme borreliosis vector. Subsequently, during 1988, endothermic vertebrates were sampled at four localities in the St. Croix Valley. Nearly 3000 birds and 200 mammals were live trapped and examined for both deer ticks and the spirochete Borrelia burgdorferi, causative agent of Lyme borreliosis. Preliminary laboratory results show that over 35% of the small mammals sampled harbor the spirochete and 6% of the migratory birds carry infected ticks. Recapture data indicates migratory birds acquire the ticks in the Saint Croix Valley and perhaps carry them elsewhere, while small mammals may serve as a local reservoir for B. burgdorferi.

CONSTITUTION OF MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

ARTICLE I. NAME AND OBJECT

1. This organization shall be named Mississippi River Research Consortium, Inc.
2. The objectives of this organization shall be:
  - a. To establish and encourage communication between river scientists and between the scientific community and the public.
  - b. To encourage pure and applied research concerning the water and land resources of the Mississippi River and its valley.
  - c. To provide an annual meeting where research results can be presented, common problems can be discussed, information can be disseminated, and where river researchers can become acquainted with each other.
  - d. To encourage cooperation between institutions and to encourage the sharing of facilities.
  - e. To function as an advisory group to other agencies.
  - f. To aid in the formation of a concerted and organized research effort on the Mississippi River.

ARTICLE II. ORGANIZATION

1. The organization of the Mississippi River Research Consortium shall be provided for by the enactment of suitable by-laws.
2. The by-laws of this organization shall designate the officers and standing committees, the provisions for the election of the officers, the conduct of meetings and for any other matters which are necessary for the government of this organization.

ARTICLE III. MEMBERSHIP AND DUES

1. The membership of this organization shall consist of any persons who demonstrate an interest in any aspect of the Mississippi River, and who express a desire to join the organization.

ARTICLE IV. AMENDMENTS

1. The constitution or the by-laws of the MRRC may be amended by an affirmative vote of two-thirds of the eligible voting members present at the annual meeting.



BY-LAWS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

ARTICLE I: NAME, PURPOSE AND DUTIES

1.01 There is hereby established a Board under the name of the Mississippi River Research Consortium Inc., having the duties of governing all matters relating to this corporation. These shall be deemed to include the following without limitation:

- (a) To have the ultimate decision making authority for any and all affairs of the Mississippi River Research Consortium, Inc. which included but is not limited to the authority to create and terminate the corporation; to determine the budget and expenditure of funds; to manage affairs; to determine the manner, location and extent of services performed by the corporation; to determine the number of, location and job duties of any employees; and to do all other and necessary work for the benefit of the corporation.
- (b) To formulate all policies necessary for the effective and continuous operation of the corporation.
- (c) To coordinate and make decisions regarding priorities of services.

1.02 The purpose of this organization shall be as follows:

- (a) To establish and encourage communication between river scientists and between the scientific community and the public.
- (b) To encourage pure and applied research concerning the water and land resources of the Mississippi River and its valley.
- (c) To provide an annual meeting where research results can be presented, common problems can be discussed, information can be disseminated, and river researchers can become acquainted with each other.
- (d) To encourage cooperation between institutions and to encourage the sharing of facilities.
- (e) To function as an advisory group to other agencies.
- (f) To aid in the formation of a concerted and organized research effort on the Mississippi River.

ARTICLE 2: OFFICES.

2.01 Principal and Business Offices

The corporation may have such principal and other offices, either within or without the State of Wisconsin, as the Board of Directors may designate or as the business of the corporation may require from time to time.

2.02 Registered Office

The registered office of the corporation required by the State of Wisconsin corporation law to be maintained in the State of Wisconsin may be, but may not be, identical with the principal office in the State Wisconsin, and the address of the registered office may be changed from time to time by the Board of Directors or by the Registered Agent. The business office of the registered agent of the corporation shall be identical to such registered office.

ARTICLE 3. BOARD OF DIRECTORS

3.01 General Powers and Number

The business and affairs of the corporation shall be managed by its Board of Directors. It shall be the responsibility of the Board to jointly organize, hold and preside over the annual meeting. The Board shall be responsible for the development of a program of technical papers to be presented at the annual meeting. The number of Directors of the corporation shall be not less than three (3) elected members.

### 3.02 Election and Term of Directors

Each director shall hold office for a term of one (1) year. The term of the office begins and ends with each annual meeting. At least one director shall be representative of an academic institution and at least one director shall be a representative of either a state or federal agency. A director may be removed from the office by an affirmative vote of a majority of the Board of Directors, taken at a meeting by the Board of Directors for the purpose. A director may resign at any time by filing a written resignation at the registered office.

### 3.03 Regular Meetings

The Board of Directors shall meet on the times and dates to be established by them but at least once per year.

### 3.04 Special Meetings

Special meetings of the Board of Directors may be called by or at the request of any officer. The president or secretary may fix the place of the meeting; and if no other place is designated or fixed, the place of the meeting shall be at the principal business office of the corporation in the State of Wisconsin.

### 3.05 Notice; Waiver

Notice of such meeting of the Board of Directors shall be given by written notice delivered personally or mailed or given by telegram to each Director at his/her home address or at such other address as such director shall have designated in writing with the secretary of the Board of Directors, in each case not less than ten (10) days prior to such meeting. Whenever any notice whatever is required to be given to any director of the corporation under the Articles of Incorporation or By-laws or any provision of law, a waiver thereof in writing, signed at any time, whether before or after the time of the meeting, by the director entitled to such notice, shall be deemed equivalent to the giving of such notice. The attendance of a director at a meeting shall constitute a waiver of notice of such meeting, except where a director attends a meeting and objects to the transaction of any business because the meeting is not lawfully called or convened. Neither the business to be transacted at, nor the purpose, or any regular or special meeting of the Board of Directors need be specified in the notice or waiver of notice of such meeting.

### 3.06 Quorum

A majority of the elected members of the Board is necessary for the transaction of business at any meeting, and a majority vote of those present shall be sufficient for any decision or election.

### 3.07 Removal

Any member of the Board who is absent from three (3) consecutive regular meetings of the Board shall, unless excused by action of the Board, cease to be a member of the Board of Directors and shall be removed forthwith.

### 3.08 Conduct of Meetings

The president and in his/her absence a vice-president and in their absence, any director chosen by the directors present shall call meetings of the Board of Directors to order and shall act as the presiding officer of the meetings. The secretary of the corporation shall act as secretary of all of the meetings of the Board of Directors, but in the absence of the Secretary, the presiding officer may appoint any assistant secretary or any director or other person present to act as secretary of the meeting.

### 3.09 Vacancy

Any vacancy occurring in the Board of Directors shall be filled as soon as possible by the majority action of the Board.

## ARTICLE 4: MEMBERSHIP AND DUES

### 4.01 Membership and Eligibility

Membership to include anyone interested in the research and study of the Upper Mississippi River and its valley.

### 4.02 Membership and Dues

Membership to be for one (1) year with annual dues determined by the Board of Directors.

ARTICLE 5: OFFICERS

5.01 Creation of Officers

The officers of the Board shall consist of a president, vice-president, secretary-treasurer and such additional assistant officers as the Board may elect.

5.02 Executive Director of the Corporation

The Board may retain and compensate and give directives to an executive officer. Said executive director shall not be considered as a member of the Board of Directors.

5.03 Election of Term Office

The officers of the corporation shall be elected by the Board of Directors at the first annual meeting following the annual meeting to serve as one (1) year term. Each officer shall hold office until his successor shall have been duly elected or until his death, resignation or removal.

5.04 Removal

Any officer or agent may be removed by the Board of Directors whenever in its judgement the best interests of the corporation shall be served thereby, but such removal shall be made without prejudice to the contract rights of person so removed. Election or appointment shall not of itself create contract rights.

5.05 Vacancies

A vacancy in any principal office because of death, resignation, removal, disqualification or otherwise, shall be filled by the Board of Directors for the unexpired portion of the term.

5.06 President

The president shall:

- (a) Act as chairperson of the Board and of any executive committee,
- (b) Appoint all committees unless otherwise specified by the Board,
- (c) Be executive on behalf of the Board of all written instruments except as provided or directed by the Board,
- (d) Be responsible for the agenda to be used at the meeting,
- (e) Perform all duties incident to the office of a president and such other duties as shall from time to time be assigned to him by the Board.

5.07 Vice-President

The vice-president, at the request of the president, shall perform the duties and exercise the functions of the president, and when so acting shall have the power of the president and shall perform such other duties as delegated by the president.

5.08 Secretary-Treasurer

The Secretary-Treasurer shall:

- (a) Keep the minutes of the meeting of the Board,
- (b) See to it that all notices are fully given in accordance with the provisions of the By-laws,
- (c) Be custodian of the records of the Board,
- (d) Perform all duties incident to the office of the Secretary of the Board, and such other duties as from time to time may be assigned by the president of the Board,
- (e) Keep all financial records of the Board,
- (f) Be responsible for record keeping and assessment of dues as established by the Board of Directors,
- (g) Supervise the preparation of the annual budget,

- (h) Perform all duties incident to the office of the treasurer of the Board and such other duties as from time to time may be assigned by the president of the Board.

5.09 Other Assistance to Acting Officers

The Board of Directors shall have the power to appoint any person to act as an assistant to any officer, or agent for the corporation in his stead, or to perform the duties of such officer when for any reason it is impractical for such officer to act personally, and such assistant or acting officer or other agent so appointed by the Board of Directors shall have all the power to perform all of the duties of the office to which he is so appointed to act, except as such powers may be otherwise defined or restricted by the Board of Directors.

ARTICLE 6: COMMITTEES

6.01 Nominating Committee

The Board of Directors shall serve as the nominating committee, and file its report with the members at the annual meeting.

6.02 Other Committees

The Board may by resolution provide for such other committees as it deems advisable and may discontinue the same at its pleasure. Each entity shall have the power and shall perform such duties as may be assigned to it by the Board and shall be appointed and the vacancies filled in the manner determined by the Board. In the absence of other direction, the president shall appoint all committees.

ARTICLE 7: MEETING OF MEMBERSHIP

7.01 Annual Meeting

The annual meeting of the organization shall be held in La Crosse, Wisconsin, with local arrangements being handled by the membership located in La Crosse, Wisconsin. The time of the meeting shall be established by the Board of Directors within the month approved by the two-thirds (2/3rds) vote of the previous annual meeting. At the meeting reports of officers and committees shall be delivered. The Board of Directors shall elect from those individuals nominated by the Nominating Committee and those nominated from the floor with prior consent of the nominee. All persons attending the annual meeting shall be required to pay membership dues for that year and be a member of the organization in order to participate. Notice of the annual meeting shall be sent in writing to all members.

7.02 Special Meetings

Special meetings may be called by the president or by a majority of the Board and shall be called by the secretary on request of five (5) members in writing. The time and place of special meetings shall be announced at least two (2) weeks in advance.

7.03 Quorum

At all meetings the members of the corporation present shall constitute a quorum for the transaction of business.

ARTICLE 8: AMENDMENTS

8.01 By the Membership

These by-laws may also be altered, amended or repealed and new By-laws may be adopted by the Board of Directors by affirmation vote of two-thirds (2/3rds) of the members present at a meeting at which a quorum is in attendance.

