Mississippi River Research Consortium

15th Annual Meeting

April 14-16, 1982

La Crosse, Wisconsin

15TH ANNUAL MEETING

MISSISSIPPI RIVER RESEARCH CONSORTIUM

14-16 April 1982

La Crosse Radisson Hotel

La Crosse, Wisconsin

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PROGRAM ARRANGEMENTS AND OFFICERS

15th Annual Meeting of the Mississippi River Research Consortium

1981-82 Executive Committee

Dr. Richard V. Anderson, Western Illinois University
Dr. David R. McConville, St. Mary's College
Dr. James G. Wiener, Columbia National Fisheries Research Laboratory

Exhibits Committee

Mr. William L. Green, Northern Prairie Wildlife Research Center
Dr. Leslie E. Holland, National Fishery Research Laboratory

Liaison with the La Crosse Radisson Hotel

Ms. Gloria J. Wiener, River Studies Center, University of Wisconsin-La Crosse

Preregistration

Ms. Karen L. Mueller, Columbia National Fisheries Research Laboratory

PROGRAM SCHEDULE

MISSISSIPPI RIVER RESEARCH CONSORTIUM

15th Annual Meeting

La Crosse Radisson Hotel

Wednesday, April 14, 1982

4:00 - 8:00 p.m.	Registration Desk Open (Main Hotel Lobby)

Thursday, April 15, 1982

7:15 a.m. - 4:00 p.m.	Registration Desk Open (Main Hotel Lobby)

---SPECIAL SESSION: CONTAMINANTS IN THE UPPER MISSISSIPPI RIVER---
(First Floor, Ballroom A & B)

Moderator: Michael R. Winfrey

8:15 - 8:20 a.m.	Welcoming Remarks. D. R. McConville
8:20 - 8:30 a.m.	Introduction. J. G. Wiener, R. V. Anderson, and D. R. McConville
8:30 - 9:00 a.m.	The ecological history of the Upper Mississippi River. C. R. Fremling and T. O. Claflin
9:00 - 9:30 a.m.	The role of contaminants in the decline of the Illinois River: Implications for the Upper Mississippi. R. E. Sparks
9:30 - 10:00 a.m.	A long-term resource monitoring plan for the Upper Mississippi River system. G. A. Jackson, C. E. Korschgen, P. A. Thiel, J. M. Besser, D. W. Steffeck, and M. H. Bockenhauer
10:00 - 10:20 a.m.	Coffee Break
10:20 - 10:40 a.m.	Establishment of an ammonia effluent limit for a major discharger to the Mississippi River. D. E. Maschwitz
10:40 - 11:00 a.m.	Changes in PCB concentrations in carp (Cyprinus carpio) from the Mississippi River. M. E. Hora
11:00 - 11:20 a.m.	The distribution and enrichment of trace metals (Cd, Cr, Cu, Ni, Pb, Zn) of bottom sediments in Navigation Pool Nos. 4 (Lake Pepin), 5, and 9 of the Upper Mississippi River. P. A. Bailey and R. G. Rada
11:20 - 11:40 a.m.	Heavy metal accumulation in selected sessile components of Fountain City Bay (Pool 5), of the Upper Mississippi River. K. J. Buhl and D. R. McConville
11:40 a.m. - 1:00 p.m.	Lunch Break

SPECIAL SESSION: CONTAMINANTS IN THE UPPER MISSISSIPPI RIVER, CONTINUED

Thursday, April 15, 1982 — Moderator: Richard E. Sparks

1:00 - 1:20 p.m.	Trace metals in the water, sediments, and fish of the Upper Mississippi River in the Twin Cities area. H. A. Boyer and D. E. Maschwitz
1:20 - 1:40 p.m.	Longitudinal distributions of As, Cd, Hg, and Pb in bed sediments of the Upper Mississippi River. J. G. Wiener and G. A. Jackson
1:40 - 2:10 p.m.	Sediments of the Upper Mississippi River: Their sources, distribution and characteristics. D. N. Nielsen, R. G. Rada, M. M. Smart, and T. O. Claflin
2:10 - 2:30 p.m.	Soil conservation and sediment fluxes in the Coon Creek Basin, Wisconsin. S. W. Trimble and S. W. Lund
2:30 - 2:50 p.m.	Estimating recent rates of sedimentation in the Upper Mississippi River. J. R. McHenry, J. C. Ritchie, C. M. Cooper, and J. Verdon
2:50 - 3:10 p.m.	Investigation of effects of navigation traffic activities on hydrologic, hydraulic, and geomorphic characteristics in the Upper Mississippi River. D. B. Simons, R. M. Li, Y. H. Chen, and S. S. Ellis
3:10 - 3:30 p.m.	Break
3:30 - 4:00 p.m.	An assessment of Corps of Engineers maintenance dredging on water quality in the Upper Mississippi River. R. J. Whiting, D. Anderson, D. Wilcox, G. Palesh, and J. Smith
4:00 - 4:20 p.m.	A ten year assessment of nutrients at selected sites on Pools 7 and 8 of the Upper Mississippi River. V. K. Dawson, G. A. Jackson, and C. E. Korschgen
4:20 - 4:40 p.m.	Effects of contaminants on naiad mollusks (Unionidae) in the Upper Mississippi River System: A review. M. E. Havlik
4:40 - 5:00 p.m.	Concluding Remarks. S. N. Luoma

Thursday Evening

7:00 p.m.	Informal Social Gathering (La Crosse Pump House, 119 King Street)

Friday, April 16, 1982

7:30 a.m. - 12:00 noon	Registration Desk Open (Main Hotel Lobby)
Concurrent Session IA	(First Floor, Ballroom A)
	Moderator: Kenneth S. Lubinski
8:15 - 8:35 a.m.	Observations of food partitioning in three species of juvenile fishes in a backwater habitat of the Upper Mississippi River. M. L. Huston and L. E. Holland
8:35 - 8:55 a.m.	An evaluation of the ichthyoplankton drift in the vicinity of Dairyland Power Cooperative's electrical generating facilities on Pool 5 of the Upper Mississippi River near Alma, Wisconsin. W. J. Kowalski, J. C. Thiel, and G. L. Johnston
8:55 - 9:15 a.m.	Relative utilization of Mississippi River habitats as fish nursery areas. A. R. Van Vooren
9:15 - 9:35 a.m.	Spatial and temporal distribution of ichthyoplankton in Pool 7 of the Upper Mississippi River. L. E. Holland and J. R. Sylvester
9:35 - 9:50 a.m.	Coffee Break
9:50 - 10:10 a.m.	Freshwater drum spawning and fecundity in the Upper Mississippi River. T. J. Goeman.
10:10 - 10:30 a.m.	A preliminary evaluation of backwater and side channel utilization by common fishes in Pool 7. J. R. Sylvester, L. E. Holland, and J. D. Broughton
10:30 - 10:50 a.m.	Evaluation of continuous walleye and sauger fishing in Pool 4 of the Mississippi River. W. C. Thorn

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Concurrent Session IB	(First Floor, Ballroom B)
	Moderator: Daniel W. McGuiness
8:15 - 8:35 a.m.	Accretion patterns behind dikes on the middle Mississippi River. G. Stevens and C. N. Strauser
8:35 - 8:55 a.m.	Investigations and comparisons of theories directly related to the cause of bed forms. D. S. Mueller
8:55 - 9:15 a.m.	Investigation of effects of navigation development and maintenance activities on hydrologic, hydraulic, and geomorphic characteristics. D. B. Simons, R. M. Li, Y. H. Chen, and S. S. Ellis
9:15 - 9:35 a.m.	Analysis of Upper Mississippi River system relationships between selected physical, biological and navigation variables. K. S. Lubinski, M. Wallendorf, and M. Reese
9:35 - 9:50 a.m.	Coffee Break
9:50 - 10:10 a.m.	Effects of the Mississippi River system on ground-water flow in southeastern Minnesota. D. G. Woodward
10:10 - 10:30 a.m.	Evaluation of polychlorinated biphenyls in fish fillets from Lake Winona. G. J. Lauer and R. A. Faber
10:30 - 10:50 a.m.	PCB's and other chlorinated hydrocarbons in heron and egret eggs from the Upper Mississippi River. J. Nosek and R. A. Faber

Friday, April 16, 1982

10:50 - 11:50 a.m.	Business Meeting (Ballroom A and B)
11:50 a.m. - 12:50 p.m.	Lunch Break
12:50 - 1:30 p.m.	Special Presentation (Ballroom A)

The Upper Mississippi River: A River in Turmoil

A narrated slide presentation by Dr. Richard F. Ashley, Program Director for the Schlitz Audubon Center at Milwaukee, Wisconsin. Dr. Ashley's program was developed from slides of the Upper Mississippi River System taken since 1979 and was supported in its development by the Andrew W. Mellon Foundation through the National Audubon Society.

Friday, April 16, 1982

Concurrent Session IIA — (First Floor, Ballroom A)

Moderator: Leslie E. Holland

1:35 - 1:55 p.m.	Paddlefish movement and habitat use in the Upper Mississippi River. P. D. Southall and W. A. Hubert
1:55 - 2:15 p.m.	Sedimentation rates and standing stock estimates in selected sloughs of Pool 14 of the Mississippi River. T. I. Hiebert, H. F. Bernhard, P. H. Howe, and D. R. Helms
2:15 - 2:35 p.m.	Influence of wing dam notching on fish, aquatic macroinvertebrates, and physicochemical characteristics in Pool 13, Upper Mississippi River. S. D. Corley, and D. W. Coble
2:35 - 2:55 p.m.	Transport of aquatic fauna from backwaters to the main channel of the Mississippi River. J. W. Eckblad
2:55 - 3:10 p.m.	Break
3:10 - 3:30 p.m.	The association of trichopterans and mollusks in lower reaches of Pool 19, Mississippi River. R. V. Anderson and W. S. Vinikour
3:30 - 3:50 p.m.	Preliminary investigations of host specificity in the endangered mussel, Lampsilis higginsi and its congener, L. ventricosa. T. W. Kammer, L. E. Holland, and J. R. Sylvester
3:50 - 4:10 p.m.	A preliminary report on muskrat habitat and population parameters in Pool 9. R. T. Clay and W. R. Clark

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Concurrent Session IIB — (First Floor, Ballroom B)

Moderator: William L. Green

1:35 - 1:55 p.m.	The quantity and nutritive quality of Vallisneria americana in Navigation Pool No. 9 of the Upper Mississippi River. G. N. Donnermeyer
1:55 - 2:15 p.m.	The potential effects of expanding macrophyte development on channel border benthic communities. M. A. Grove, R. V. Anderson, and D. Day
2:15 - 2:35 p.m.	The case for gene bank conservation in the Upper Mississippi River: Azolla (Polypodiophyta: Azollaceae) and biological nitrogen-fixation. J. H. Peck
2:35 - 2:55 p.m.	A study of the phycoperiphyton on glass slide substrates with a comparison to natural substrates. M. R. Luttenton
2:55 - 3:10 p.m.	Break
3:10 - 3:30 p.m.	A practical funding approach for on-going study, monitoring, and management of the fish and wildlife of the Upper Mississippi River. M. J. Vanderford
3:30 - 3:50 p.m.	The mitigation and enhancement handbook for the Upper Mississippi River System (UMRS) and other large river systems. R. A. Schnick, J. M. Morton, J. C. Mochalski, and J. T. Beall
3:50 - 4:10 p.m.	Recreation as a source of conflict in river basin management. J. D. Absher
4:10 - 4:30 p.m.	A water quality and sediment contaminant screening survey in the Mississippi River at St. Louis, November 1980 through September 1981. M. King
4:30 p.m.	Meeting adjourned

EXHIBITORS

The 15th Annual Meeting of the Mississippi River Research Consortium will feature exhibits by a number of equipment suppliers and publishers of scientific literature. Each exhibitor has paid a fee for displaying his/her wares at the meeting. The scientific exhibits are located in the Minnesota Room on the second floor of the hotel, which will be open from 7:15 a.m. to 5:30 p.m. on Thursday, April 15, and from 7:15 a.m. until 3:30 p.m. on Friday, April 16. Coffee, tea, and Sanka will be available in the hallway outside of the Minnesota Room during morning coffee breaks. Please make a point of viewing the exhibits during your visit.

Equipment Exhibitors

A.B. Dick Products

Advanced Telemetry Systems, Inc.

American Scientific Products

Fisher Scientific Company

Hydrolab Corporation

Mettler

Wildlife Materials, Inc.

Wyoming Biotelemetry, Inc.

Publication Exhibitors

American Fisheries Society

Ann Arbor Science Publishers, Inc.

Iowa State University Press

University of Minnesota Press

ACKNOWLEDGMENTS

The following persons and institutions have contributed substantially to the planning, execution, support, and ultimately, the success of the 15th Annual Meeting. The 1981-82 Executive Committee gratefully acknowledges their involvement.

Meeting Arrangements

Thomas O. Claflin, River Studies Center, University of Wisconsin-La Crosse

William L. Green, Northern Prairie Wildlife Research Center

Leslie E. Holland, National Fishery Research Laboratory

Gloria J. Wiener, River Studies Center, University of Wisconsin-La Crosse

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The University of Wisconsin-La Crosse Foundation

Mailing List, Newsletters, Program, and Registration

Beverly A. Erickson, University of Wisconsin-La Crosse

Richard A. Jacobson, Columbia National Fisheries Research Laboratory

Barbara M. Krummes, Columbia National Fisheries Research Laboratory

Karen L. Mueller, Columbia National Fisheries Research Laboratory

Gloria J. Wiener, River Studies Center, University of Wisconsin-La Crosse

Technical Session Moderators

William L. Green, Northern Prairie Wildlife Research Center

Leslie E. Holland, National Fishery Research Laboratory

Kenneth S. Lubinski, Illinois Natural History Survey

Daniel W. McGuiness, Dan McGuiness & Associates

Richard E. Sparks, Illinois Natural History Survey

Michael R. Winfrey, University of Wisconsin-La Crosse

ACKNOWLEDGMENTS (Continued)

Paper Judges

Dr. James W. Eckblad, Luther College

Ms. Marian E. Havlik, Malacological Consultants

Mr. Tom I. Hiebert, Commonwealth Edison Co.

Dr. Leslie E. Holland, National Fisheries Research Laboratory

Mr. James A. Holzer, Wisconsin Department of Natural Resources

Dr. Wayne A. Hubert, Iowa Cooperative Fisheries Research Unit

Dr. Joseph D. Ives, Western Illinois University

Dr. David M. Kennedy, Wisconsin Department of Natural Resources

Assistance with Visual Aids and Exhibits

Patricia Bailey, University of Wisconsin-La Crosse

Steven Callister, University of Wisconsin-La Crosse

David Day, Western Illinois University

John Findley, University of Wisconsin-La Crosse

Thomas Hornung, University of Wisconsin-La Crosse

Richard Jacobson, Columbia National Fisheries Research Laboratory

Kerri Johnson, University of Wisconsin-La Crosse

Susan Littlejohn, University of Wisconsin-La Crosse

Penny Schmidt, University of Wisconsin-La Crosse

David Tillard, Western Illinois University

AGENDA: ANNUAL BUSINESS MEETING

Mississippi River Research Consortium

10:50 a.m., 16 April 1982

Ballroom A and B, La Crosse Radisson Hotel

Chairperson: Richard V. Anderson

1. Accomplishments during 1981-82
2. Expressions of appreciation to those involved with planning, execution, and support of the 15th Annual Meeting
3. Financial status of the Consortium
4. Proposal for annual payment of membership dues by all members, regardless of attendance of the annual meeting
5. Publication of the proceedings (Contaminants in the Upper Mississippi River)
6. Consideration of resolution submitted by Dr. David Kennedy
7. The MRRC Logo
8. Timing of the 16th Annual Meeting (1983): Potential conflict with NABS
9. Other business
10. Nomination and election of officers

Your participation in the annual business meeting is the key to ensuring that the Consortium is responsive to the needs of its membership. Please attend.

RESOLUTION

MISSISSIPPI RIVER RESEARCH CONSORTIUM

Resolution wherein the Mississippi River Research Consortium supports the "Upper Mississippi River System Management Act" H. R. 5459, presently being deliberated by the House of Representatives of the United States Congress.

WHEREAS, the Mississippi River Research Consortium is dedicated to a better scientific understanding of the Upper Mississippi River System and to maintaining the unique habitats and environmental qualities of this resource, and

WHEREAS, the Mississippi River Research Consortium membership feels that the studies completed under the Upper Mississippi River System Master Plan are inadequate to address the problems created by future navigation expansion and development of the Upper Mississippi River System, and

WHEREAS, the Upper Mississippi River System Management Act provides a logical continuation of those studies not completed in the Master Plan, and

WHEREAS, the enactment of H. R. 5459 could allow at least two years of additional study and implementation of the habitat rehabilitation and enhancement program before a final decision to expand navigation on the Upper Mississippi River System is needed, and

WHEREAS, the implementation of a long-term resource monitoring program and a computerized inventory and analysis system will provide scientifically valid data on which to make management decisions that will help prevent further deterioration of this national resource, and

WHEREAS, the 1200-foot lock at Lock and Dam 26 presently under construction will meet all future traffic expansion needs at least until 1993 and possibly until 2010 if waterway users' fees are increased, and

WHEREAS, many of the members of the Mississippi River Research Consortium actively participated in the research which led to many of the recommendations of the Upper Mississippi River System Master Plan which are found in H. R. 5459, and

WHEREAS, the members of the Mississippi River Research Consortium recognize that the environmental quality of this resource is rapidly declining and will continue to do so unless rehabilitation measures are taken in the near future

NOW, THEREFORE BE IT RESOLVED that the Mississippi River Research Consortium:

1. Supports all aspects of the Upper Mississippi River System Management Act as found in H. R. 5459.

2. Recommends that Congress immediately pass and fund this Act for at least a two-year period before any additional navigation expansion measures are implemented.

Dated this 16th day of April, 1982.

MISSISSIPPI RIVER RESEARCH CONSORTIUM

PAST MEETINGS AND OFFICERS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

Meeting	Year	Place	President
1st	1968	St. Mary's College, Winona	Brother George Pahl
2nd	1969	Wisconsin State University, 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		
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. Michael Vanderford

CONSTITUTION
OF
THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

ARTICLE I. NAME AND OBJECT

1. This organization shall be named the Mississippi River Research Consortium.

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 demonstate 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

ARTICLE II. ORGANIZATION

Section I. Officers

A. The officers of the MRRC shall consist of a 3-member Executive Board elected each year at the annual meeting.

B. The Executive Board will consist of at least one representative of an academic institution and at least one representative of either a state or Federal agency.

C. The Executive Board shall choose one of its 3 members to serve as President or Executive Board Chairman for the next year.

D. It shall be the primary responsibility of the three Executive Board members to jointly organize, hold and preside over the next annual meeting. Included in these responsibilities is the development of a program of technical papers to be part of the annual meeting.

E. One member of each Executive Board shall be elected to serve on the succeeding Executive Board.

Section II. Meetings

A. There shall be one meeting held each calendar year.

B. The meeting shall be held in La Crosse, Wisconsin, with local arrangements responsibility being handled by a MRRC member located in La Crosse.

C. The time of the meeting shall be established by the Executive Board within the month approved by a two-thirds vote of the MRRC membership at the annual meeting.

D. The annual meeting shall include one session designated to transact the necessary business of the organization.

E. Due notice of the annual meeting shall be sent in writing to all members.

F. At the annual meeting, the eligible voting members of the organization shall constitute a quorum for the transaction of buiness.

ARTICLE III. MEMBERSHIP AND DUES

Section I. Dues

Dues shall be set by the Executive Board each year adequate to cover printing, mailings and guest speaker costs for the next annual meeting and any special MRRC meetings.

Section II. Membership

All persons attending an annual meeting will be required to pay the established dues for that year and will be members of the MRRC.

ABSTRACTS FOR SPECIAL SESSION

"CONTAMINANTS IN

THE UPPER MISSISSIPPI RIVER"

Thursday, 15 April 1982

Abstracts are Listed Alphabetically
by Senior Author

Proceedings of this Symposium will be published
in book form by
Ann Arbor Science Publishers, Inc., after peer review

THE DISTRIBUTION AND ENRICHMENT OF TRACE METALS (Cd, Cr, Cu, Ni, Pb, Zn) OF BOTTOM SEDIMENTS IN NAVIGATION POOL NOS. 4 (LAKE PEPIN), 5, AND 9 OF THE UPPER MISSISSIPPI RIVER

P. A. Bailey and R. G. Rada
River Studies Center, University of Wisconsin-La Crosse
La Crosse, WI 54601

A study was undertaken during the summers of 1978-81 to characterize the sediments (grain size, six trace elements, and organic content) in Navigation Pool Nos. 4, 5, and 9 of the Upper Mississippi River. Discrete surface sediments were obtained from 1) above and within Lake Pepin, 2) Weaver Bottoms, and 3) Pool No. 9. Distributions of metals in these areas were compared to determine whether Lake Pepin, with its high trapping efficiency, serves as a sink for sediment-bound metals.

To correct for preferential occurrence of metals on fine-grained sediments, individual metal concentrations were regressed against the fraction of particles <4μm in dia. Slopes of the regression lines were used to compare metal concentrations in each area. The data demonstrates that sediments upstream from and within the lake have a greater content of Cd, Cr, Cu, Pb, and Zn as compared to sediments from Weaver Bottoms and Pool No. 9. Differences among areas were not observed for Ni.

TRACE METALS IN THE WATER, SEDIMENTS, AND FISH OF THE UPPER MISSISSIPPI RIVER IN THE TWIN CITIES AREA

H. A. Boyer and D. E. Maschwitz
Metropolitan Waste Control Commission (MWCC), St. Paul, MN 55101
and
Minnesota Pollution Control Agency (MPCA)
Roseville, MN 55113

Sampling was conducted cooperatively by the MWCC, MPCA, and MDNR during September of 1981 for selected trace metals in the water, sediments, and fish of the Upper Mississippi River. Existing information for the river in the Twin Cities Area suggested additional toxics' data were needed for evaluating the effectiveness of an industrial pretreatment program and for assessing the significance of any water quality or public health problems related to the current concentrations of trace metals.

Eleven total and dissolved metals plus cyanide were measured in the water column at seven locations extending from Anoka, MN to Red Wing, MN (Pool 3). Percent organic content and concentrations of eleven metals plus cyanide were determined for two sediment-size classes (<0.063 mm; 0.063-2.0 mm) at the seven sites. In addition, dry and inorganic weights were measured for each of seven particle size-fractions. Selected trace metal concentrations in fish were determined for the edible portions of rough fish (carp) and game species (smallmouth bass, black crappie, walleye, and sauger) collected at the seven sites.

The results of these various analyses are summarized and will be used to evaluate the need for and extent of an ongoing toxics' monitoring program for the Twin Cities Metropolitan Area.

HEAVY METAL ACCUMULATION IN SELECTED SESSILE COMPONENTS OF FOUNTAIN CITY BAY, POOL 5A, OF THE UPPER MISSISSIPPI RIVER

Kevin J. Buhl and David R. McConville
Biology Department, St. Mary's College, Winona, MN 55987

Concentrations of Cd, Cr, Cu, and Zn were determined in four species of aquatic macrophytes and bottom sediments to obtain baseline data on metal accumulation and distribution patterns in backwater ecosystems of the Upper Mississippi River. Total metal content in each component was determined by wet digestion procedures ($HC1O_4$ and HNO_3) and atomic absorption spectroscopy.

Analysis of variance testing indicated that metal concentrations in plant tissues were not significantly different between geographic locations in the study area. However, an accumulation gradient was observed for all four metals in plant tissue with the Student-Newman-Keuls multiple range test. Broadleaf arrowhead roots and coontail accumulated significantly higher levels of Cd and Zn than other tissues ($p < 0.001$). Arrowhead roots contained the highest amounts of Cr and Cu ($p < 0.05$), intermediate enrichment was found in broadleaf pondweed and water lily shoots. Lily rhizomes and arrowhead shoots exhibited the least amount of metal accumulation. Intraspecies comparisons revealed metal partitioning between shoots and subterranean tissues. Lily shoots contained significantly ($p < 0.05$) higher levels of Cd, Cr, and Zn than rhizomes, whereas arrowhead roots accumulated significantly higher amounts of all four metals compared to shoot tissues ($p < 0.001$).

The geographic distribution pattern of metals in sediments was superseded by sediment grain size effects. Strong coefficient of determination values were obtained when metal concentration in sediments were regressed against textural composition. No significant correlations were found between metal concentrations in plants and sediments. Similar amounts of Cr, Cu, and Zn were present in sediments and arrowhead roots. The highest levels of Cd were found in coontail and arrowhead roots. The data suggests that coontail may act as a sink for metals in the water column and arrowhead roots may serve as a biological reservoir for metals in the bed sediments.

A TEN YEAR ASSESSMENT OF NUTRIENTS AT SELECTED SITES ON POOLS 7 AND 8 OF THE UPPER MISSISSIPPI RIVER

Verdel K. Dawson, Gerry A. Jackson, and Carl E. Korschgen
U.S. Fish and Wildlife Service
National Fishery Research Laboratory
P.O. Box 818, La Crosse, WI 54601
and
Columbia National Fisheries Research Laboratory, Field Research Laboratory
P.O. Box 936, La Crosse, WI 54601
and
Northern Prairie Wildlife Research Center, Field Station
P.O. Box 2226, La Crosse, WI 54601

Water chemistry parameters on selected tributaries and sites on pools 7 and 8 of the Upper Mississippi River have been monitored since 1971. Sampling sites include the Mississippi River main channel near La Crosse, WI and near Dakota, MN; the Black River at Lytles Bridge on Brice Prairie and at the Clinton Street Bridge, La Crosse, WI; the La Crosse River near its confluence with the Mississippi River; and Halfway Creek near Lake Onalaska. Monthly samples were taken year-round and analyzed according to standardized procedures for temperature, pH, total alkalinity, total hardness, ammonia, nitrite, nitrate, phosphate, conductivity, dissolved oxygen, suspended solids, chemical oxygen demand, and biochemical oxygen demand. Statistical analyses have been used to evaluate correlations among various water chemistry parameters and with river discharge. Several parameters showed definite seasonal trends. Nitrates were generally lowest in the summer, especially during August; however, nitrites were highest in summer. Ammonia concentrations were highest during the winter, especially during periods of heavy ice and snow cover. Phosphates were slightly lower in winter but were significantly elevated during August. Increased algal and aquatic macrophyte production during the summer probably resulted in the slightly elevated pH's observed at that time. Dissolved oxygen concentrations dropped slightly during warmer periods, but were generally between 70% and 100% of saturation year-round. The greatest differences between years were observed during the spring season and could be related with periods of flooding. For the most part, annual changes in the overall water quality at any of the selected sites were surprisingly small during the 10-year study period.

THE ECOLOGICAL HISTORY OF THE UPPER MISSISSIPPI RIVER

C. R. Fremling and T. O. Claflin
Department of Biology, Winona State University, Winona, MN 55987
and
River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601

The Upper Mississippi River has experienced several erosional and depositional episodes during its geological history. The valley through which it flows was formed approximately 14,000 years ago due to the high discharge of glacial melt water. During this period, the valley floor was lowered by as much as 400 ft. Glacial recession resulted in the decrease in flow, and the valley floor slowly filled with sediment to its present level. Subsequent erosion of surrounding highlands formed the floodplain structures that presently exist. During the 19th century, westward expansion in North America created a demand for riverine modifications to accommodate navigation. A series of wing dams and closing dams were constructed to modify and stabilize the channel. Furthermore, during the 1930s, a series of low head dams and navigation locks were constructed between Minneapolis, Minnesota and St. Louis, Missouri. The closure of these structures resulted in the inundation of the floodplain by forming a series of shallow impoundments along the course of the river.

The river, previously an open flowing system, was converted to one dominated by reservoir dynamics. Presently, the shallow reservoirs continue to trap nutrients, sediments, and associated materials. As a result, the fragile, productive backwater areas of the reservoirs are susceptable to eutrophication and the accumulation of potentially toxic contaminants. As these processes continue, the ability of the river system to support a diverse fauna and flora will likely decrease; consequently, there will be a trend toward decreasing water quality of this riverine resource.

EFFECTS OF CONTAMINANTS ON NAIAD MOLLUSKS (UNIONIDAE) IN THE UPPER MISSISSIPPI RIVER SYSTEM: A REVIEW

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The importance of naiad mollusks as environmental indicators has not been fully explored. Results of this literature review indicate an increasing number of publications on the effects of contaminants on these organisms. Although little work has been directed at specific impacts of contaminants, most circumstantial evidence suggests that contaminants may be responsible for decreases in naiad population density and diversity. Over one-third of the naiad species historically found in the Upper Mississippi River main stem are now barely surviving, or are nearly extirpated.

Limited studies have been done on trace metals, such as copper, iron, mercury, and zinc, and on pesticides such as DDT, aldrin, dieldrin, and antimycin. Isotopes of phosphorus, strontium, and cesium have an affinity for naiad bodies and/or shells.

A number of questions are still unresolved. For example, why is Amblema p. plicata (Three Ridge) a tolerant species and to what extent can this species tolerate the various contaminants present in the Upper Mississippi River? Also, why have species such as Tritogonia verrucosa (Buckhorn) ceased to exist in areas where siltation is not the obvious problem in otherwise seemingly suitable habitat? Two naiad species, Megalonaias nervosa (Washboard) and Obovaria olivaria (Hickory Nut), seem to be associated with populations of the endangered Lampsilis higginsi (Higgins' Eye); yet the first two species are seldom found above Lock and Dam 8, Genoa, Wisconsin. This suggests that research on M. nervosa and O. olivaria might provide some of the answers for L. higginsi and perhaps other rare species.

CHANGES IN PCB CONCENTRATIONS IN CARP (CYPRINUS CARPIO) FROM THE MISSISSIPPI RIVER

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In 1975 the PCB contamination problem of the Mississippi River was recognized as a serious concern. Fish taken from various areas of the river contained concentrations of PCBs which violated the U.S. Food and Drug Administration tolerance level of 5 mg/Kg. An interagency task force was formed and conducted a thorough investigation of the problem during 1975 and 1976. The task force confirmed the PCB problem in the river and delineated areas where high levels of PCBs were found in fish. Since that time a great deal of public awareness concerning the hazards of PCBs has occurred and both state and national legislation controlling PCBs has been enacted. The Minnesota Pollution Control Agency is attempting to determine the changes in PCB concentrations in fish from the Mississippi River as a result of these actions. In 1979 and 1980, carp were collected from the same eight locations in the Mississippi River that were sampled in 1975 and 1976. The carp were composited into eight samples of three size classes. The data collected in 1975 and 1976 was compared to that collected later. Preliminary results indicate a significant decrease in PCB levels in carp from some areas of the Mississippi River.

LONG-TERM RESOURCE MONITORING PLAN FOR THE UPPER MISSISSIPPI RIVER SYSTEM

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The Upper Mississippi River System (UMRS) is being rapidly and irreversibly altered by impacts resulting from increased urban, industrial, and agricultural development. Past exploitation has clearly established that the resources of the system are not limitless. Numerous activities (e.g. increased navigation, dredging, barge fleeting, construction, wetland development, intensive agricultural practices and the associated sediment and chemical impacts, industrial waste dischargers, and increased recreational pressures) have stressed many areas of the system beyond their assimilative capacity and threaten the fish, wildlife, recreational, and economic resources of the entire region. Problems associated with these activities are becoming increasingly complex, and lack of information has made it difficult for federal and state agencies to adequately manage the river system for all users. It is mandatory that managers and administrators be provided with scientifically sound information on which to base decisions that will ultimately determine the fate of the system.

In 1978 Congress mandated the Upper Mississippi River Basin Commission, through the Inland Waterway Authorization Act (P.L. 95-502), to draft a comprehensive Master Plan for management of the UMRS. The defined area included the commercially navigable portions of the main stem of the Mississippi River north of Cairo, Illinois; Minnesota River; St. Croix River; Black River; Illinois River and Waterway; and Kaskaskia River. Included in this authorization was the instruction to design a resource monitoring plan to document long- and short-term ecological impacts of present and projected expansion of navigation and related activities on the fish and wildlife, water quality, wilderness, and recreational opportunities of the UMRS.

Information on a system as large and diverse as the UMRS can be accumulated only through a properly designed and implemented comprehensive data collection and interpretation program. Past attempts to implement such a program on the UMRS have been unsuccessful because of 1) lack of an integrated plan; 2) lack of adequate funding and personnel; 3) lack of a designated lead agency; and 4) low priority consideration of the UMRS as a multiple-use resource. The purpose of the present study was to establish a foundation for the development of a comprehensive Long-Term Resource Monitoring Program for the UMRS, which must be designed to collect scientifically valid and statistically testable data through time, to detect site-specific or system-wide changes.

ESTABLISHMENT OF AN AMMONIA EFFLUENT LIMIT FOR A MAJOR DISCHARGER TO THE MISSISSIPPI RIVER

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Ammonia, especially in the un-ionized form, is toxic to aquatic life. The discharge from the Metropolitan Wastewater Treatment Plant (Metro Plant) in St. Paul increases the load of total ammonia in the Mississippi River by about 2.5 times during the summer months. The current ammonia water quality standard of 0.04 mg/l un-ionized ammonia (as N) is exceeded more than 30 percent of the time during the summer months below the Metro Plant as indicated by eight years of routine water quality data.

An ammonia effluent limit for the Metro Plant was calculated using a mass balance approach, and was intended to protect the water quality standard under average conditions at the design low river flow ($7Q_{10}$). The amount of un-ionized ammonia in solution is very sensitive to ambient pH and moderately sensitive to ambient temperature. Thus, the definition of ambient conditions upon which the ammonia effluent limit will be based is very important. Analysis of available water quality data indicates that 1) pH, temperature, and total ammonia are stable for ten miles below the discharge, 2) a rise in pH below this point, which increases the concentration of un-ionized ammonia, is partially offset by reduced total ammonia concentrations, and 3) the relationship between pH and river flow is poor. Extrapolation of historical conditions into the future indicates a probable downstream pH of 7.9 and a temperature of 25°C. An effluent limit derived from these conditions, and met by the discharger, should reduce the level of downstream violations of the water quality standard to five to ten percent of the time during the summer months.

ESTIMATING RECENT RATES OF SEDIMENTATION IN THE UPPER MISSISSIPPI RIVER

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Sedimentation rates of backwater lakes in the upper Mississippi River, Lake Pepin to Guttenberg, Iowa, and in Pool 14 were determined from measured concentrations of cesium-137 of deposited sediment profiles. Throughout the sampled reach, fine sediments are accumulating at rates up to 5 cm/yr. Rates from 1964 to present are somewhat less than in the period 1954-64. Measurements of other sediment parameters were also made. In general, higher concentrations of ^{137}Cs are found associated with high clay and organic matter contents. The useful life of many of the backwater lakes is limited to 50 to 100 years assuming present conditions prevail. Off river sedimentation rates in Wisconsin tributaries are of a similar magnitude. Impoundments are subject to rapid aging in agricultural environments. Prolonging the useful life of these valuable water bodies is dependent on vastly increased land conservation practices.

SEDIMENTS OF THE UPPER MISSISSIPPI RIVER: THEIR SOURCES, DISTRIBUTION AND CHARACTERISTICS

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Sediments in the Upper Mississippi River within the driftless section of the central lowlands province are derived from both Paleozoic and Quarternary age sediments. Texturally-mature Paleozoic clastic rocks provide well-sorted quartz sand where tributary streams have exposed them to erosional processes. Recent field studies have shown, however, that the large sand-carrying tributaries of the Mississippi River are supplied mostly with sand derived from bank erosion of terraces composed of glacial outwash. Silt and clay size sediments constitute the suspended load of the Mississippi. These sediments are primarily derived from upland erosion of Quarternary soil and loess in regions of extensive agriculture, e.g. eastern Iowa and southwestern Wisconsin. Such areas typically yield up to 500 tons of silt and clay $mi^{-2} \cdot yr^{-1}$.

Prior to lock and dam construction, the Upper Mississippi was essentially an island-braided river still undergoing adjustment to post-glacial climatic conditions. The floodplain of the pre-impounded Mississippi was composed of 1) overbank silt and clays deposited during floods, and 2) tributary deltaic sediments. Subsequent to impoundment, lower reaches of navigation pools were continuously inundated, which resulted in a lower energy river regime causing deposition of fine grain sediments. The deposition of fine sediments has resulted in the widespread conversion of open water to shallow water habitat. Differential rates of sedimentation among pools is generally attributed to characteristics of tributary streams and watersheds.

INVESTIGATION OF EFFECTS OF NAVIGATION TRAFFIC ACTIVITIES ON HYDROLOGIC, HYDRAULIC, AND GEOMORPHIC CHARACTERISTICS IN THE UPPER MISSISSIPPI RIVER

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Tow traffic alters the physical character of the upper Mississippi and Illinois Rivers. Tow and barge passages temporarily increase the water's velocity and generate wave action against the shore. Bottom sediments become resuspended and banks may erode. The result is an increase in suspended sediment concentrations and turbidity levels. Sediment volumes entering side channels and backwater areas may increase above natural levels due to changes in water velocities and suspended sediment concentrations. In this study, towboat-induced changes to the physical environment are investigated. The following factors are considered in this report: natural flow velocity, boat-generated wave heights and velocity changes, wave wash in relation to bank stability, sediment resuspension and suspended sediment concentrations, turbidity, and sediment volumes entering side channels and backwater areas.

The effects of different traffic levels and patterns on these factors are discussed. Our analysis considers two basic traffic patterns: (1) uniformly distributed and (2) overlapping distribution. "Overlapping distribution" refers to upstream- and downstream-bound tows that pass each other. "Uniformly distributed" refers to tows traveling in the same direction separated by a fixed distance. Effects of other traffic patterns will fall within the range of these two patterns. The effects of existing (year 1977) and projected (years 2000 and 2040) traffic levels are evaluated.

THE ROLE OF CONTAMINANTS IN THE DECLINE OF THE ILLINOIS RIVER: IMPLICATIONS FOR THE UPPER MISSISSIPPI

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In 1908, the value of the catch of freshwater fish from the Illinois River exceeded that of any other river in America (excluding rivers with anadromous fishes), and over 2000 commercial fishermen worked on the river. The Illinois River catch was 10% of total freshwater fish production in the United States. By 1976 only 2 full-time fishermen worked the Illinois and the 1973 harvest was only 0.32% of the U.S. Total. Up to 3.5 million diving ducks once migrated down the Illinois Valley each fall. Since the 1950's, only a tenth of that number use the river.

The Illinois River ecosystem shifted rapidly in the 1950's from a remarkably productive alluvial river, flanked by clear, vegetated backwaters and lakes to a turbid, rather sterile main channel bordered by turbid, vegetationless lakes filled with watery, dispersed sediments easily resuspended by wind-generated waves. Mud-bottom communities of fingernail clams and burrowing mayflies died out in 1955. Sediments in parts of the Illinois River now contain an unidentified factor which is lethal to fingernail clams, and ammonia levels in some reaches also exceed lethal thresholds. A positive feedback loop was set up in the late 1950's when aquatic plants began to be affected by increasing turbidity and unstable water levels. As plants began to die, there were fewer stems and leaves to dampen wave action and fewer roots to anchor the bottom, so wind- and probably boat-generated waves more easily resuspended bottom sediments and tore up remaining plant beds. Aquatic plants utilize ammonia as a nutrient, so ammonia levels may have increased. Fish populations in the now-shallow lakes die out during episodes of low oxygen and elevated water temperatures in mid-summer and are subject to both low oxygen and freeze-out in mid-winter. There are no submerged aquatic plants to shelter juvenile fish or provide a substrate for the insects and snails upon which they feed. Fishes that are sight feeders and nest-builders have difficulty finding food and reproducing. Food webs have been simplified and shortened, so that organic matter exerts an oxygen demand as a result of microbial decay, rather than being converted into invertebrate biomass, thence into fish and ducks.

The Illinois River now is a stable, degraded (but not worthless) system that will be difficult, if not impossible, to restore to its former level of productivity. Recent declines in fingernail clam populations in Pools 19 and 8 and in aquatic vegetation in Pool 8 may be warnings that the Upper Mississippi River could suffer the same fate as the Illinois.

SOIL CONSERVATION AND SEDIMENT FLUXES IN THE CORN CREEK BASIN, WISCONSIN

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The Coon Creek basin, like most of the Driftless Area of the upper Midwest, has been strikingly transformed by soil conservation measures since the 1930s. As a result, erosion and sedimentation rates have been greatly decreased. Estimated upland erosion rates in 1975 were only about one-fourth of those of 1934 while measured valley sedimentation rates of recent years were only 1-2% of those of the 1930s. Erosion and sedimentation were functions of Erosive Land Use (a composite index of land use and land treatment) but both erosion and sedimentation demonstrated a time lag in their relationship with Erosive Land Use. Climatic changes do not appear to have been a causal factor on the observed trends of erosion and sedimentation. Although erosion and valley sedimentation rates have been greatly decreased, sediment yield to the Mississippi River remains at the same magnitude as before soil conservation. Measurements indicate that much of the present sediment yield is coming from stream erosion of sediment stored in the valley during historic times and hence may continue near their present levels during the foreseeable future.

AN ASSESSMENT OF CORPS OF ENGINEERS MAINTENANCE DREDGING ON WATER QUALITY IN THE UPPER MISSISSIPPI RIVER

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In response to various Federal laws and regulations, the St. Paul District, Corps of Engineers, has over the past 8 years collected a large amount of data concerning the water quality effects of its maintenance dredging activities on the Upper Mississippi River. The types of investigations in this data base include: physical and chemical properties of dredged material; solid and suspended phase sediment bioassays designed to determine acute toxicity and bioaccumulation potential; and several in-field monitoring studies of dredging operations. This paper summarizes the conclusions of these and other studies in the St. Paul District into an overview assessment of Corps of Engineers maintenance dredging on water quality.

LONGITUDINAL DISTRIBUTION OF As, Cd, Hg, AND Pb IN BED SEDIMENTS OF THE UPPER MISSISSIPPI RIVER

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The longitudinal distributions of selected trace elements in bed sediments of the Upper Mississippi River were assessed. Grab samples of sediments were collected during 1979 from cross-sectional transects at 19 main channel and backwater locations, extending from Sartell, Minnesota (RM ~924) to Guttenberg, Iowa (RM ~615.6). Samples were analyzed for exchangeable As, Cd, Pb, and Mn, total Hg, particle size distribution (clay, silt, and sand fractions), and organic content.

Concentrations of Cd, Hg, and Pb were much higher in sediments from Pools 2 and 4 (Lake Pepin) than in sediments from other sites. Arsenic concentrations were higher in samples from Sartell, Pool 2, and Lake Pepin than at other sampling sites. Particle size distributions of sediments varied among locations from predominantly clay and silt to predominantly sand. Concentrations of Hg and Pb, adjusted for particle size, were most highly enriched in sediments from Pools 1, 2, and 4. Cadmium concentrations, adjusted for particle size, were most highly enriched in sediments from Pool 2. Adjusted concentrations of arsenic were enriched in sediments from Sartell and Pools 2, 4, and 6.

These results suggest that contamination of the studied section of the Upper Mississippi River by potentially toxic trace elements has been limited largely to the stretch from the Twin Cities metropolitan area to lower Lake Pepin. However, samples of whole common carp (*Cyprinus carpio*), collected as far downstream as Pool 11, contained very high concentrations of As, Hg, and Pb, relative to those in common carp from other river systems in the Conterminous United States.

ABSTRACTS FOR SESSIONS

IA, IB, IIA, AND IIB

Friday, 16 April 1982

Abstracts are Listed Alphabetically by Senior Author

RECREATION AS A SOURCE OF CONFLICT IN RIVER BASIN MANAGEMENT

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A significant potential for resource conflict exists between outdoor recreation and other river system uses. Social science research has only recently begun to address the relationships between recreation and the various other river resource uses. Yet as the demand for water-base recreation grows, the potential for conflict also increases. This is especially true for the Upper Mississippi River, given the recent proposal to increase navigational capacity.

As part of the recent Upper Mississippi River Basin Commission Master Plan study, research into the recreational use of the river system was undertaken. This paper presents some selected findings from that study with a focus on (1) the kinds of resource attributes which various types of recreational users favor, (2) their perceptions of how recreational uses may conflict with other river uses, and (3) some of the river system management policies and actions that affect their satisfaction or experiential quality.

Data presented are from a three-part study of river use conducted during the spring and summer of 1981. Responses from a total of 1,560 recreationists and 256 managers or providers of services were included in the results. Overall, the results point to a lack of understanding on the part of most recreationists about many of the environmental conditions and policy or decision-making contexts which greatly affect their experiences. That is, while their perceptions of use-conflict situations are low, their aggregate desire for recreational use of the river makes increased conflict probable.

THE ASSOCIATION OF TRICHOPTERANS AND MOLLUSKS IN LOWER REACHES OF POOL 19, MISSISSIPPI RIVER

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Most caddisflies (Trichoptera) require a solid substrate on which to feed and/or pupate. In lower reaches of navigation pools on the Mississippi River, sediment accumulation results in a preponderance of soft-shifting substrates unsuitable as trichopteran habitat. However, large numbers of caddisflies do occur in these areas. Bottom samples in lower reaches of Pool 19 indicate that caddisflies, particularly the family Limnephilidae, use mollusks as a substrate for pupation. While both clams and snails were used as pupation sites, there was a size selection for larger individuals. Thus there was a minimum size related to preferred pupation sites. Density of trichopteran pupal cases was higher on clams than on snails, which may reflect the more sessile habit of the clams. Caddisflies were only found on the posterior end of clams but were somewhat randomly distributed on snail shells. No pupal cases were found on dead mollusks. Trichoptera appear to pupate on mollusks that can maintain a position on the surface of the substrate, thus preventing burial of pupae.

A PRELIMINARY REPORT ON MUSKRAT HABITAT AND POPULATION PARAMETERS IN POOL 9

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Channel side and backwater habitats were studied to determine whether the habitats differed and if water level changes due to navigation events affect arrowhead (Sagittaria latifolia), the most common muskrat habitat. Water depths were greatest in channel side habitats and water temperatures were highest in backwater habitats. Above and below ground standing crops, stem density, and area covered by arrowhead were greater in channel side areas while individual plant height and weight were greater in backwater areas. Water level fluctuations due to barge passage had no measurable impact on arrowhead abundance.

Natality of muskrat populations was greater in backwater areas (16.3 vs 13.2 young/female); however, live trapping catch/effort throughout summer was consistently greater in channel side areas. Muskrat body condition of individuals, the ratio of weight/length, did not differ between habitats. Exploitation and survival rates will be estimated using tags recovered from muskrats marked during summer and harvested by trappers in autumn. A sample of carcasses will be used to determine the age/sex composition of the harvested animals.

INFLUENCE OF WING DAM NOTCHING ON FISH, AQUATIC MACROINVERTEBRATES, AND PHYSICOCHEMICAL CHARACTERISTICS IN POOL 13, UPPER MISSISSIPPI RIVER

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Six wing dams and an adjacent side channel in Pool 13 of the Upper Mississippi River were studied during 1978-80 to determine effects of wing dam notching on fish, aquatic macroinvertebrates, hydrographic relief, current velocity, substrate, dissolved oxygen, and water temperature. Three wing dams were notched in May-June, 1979. Fish catches decreased with increasing discharge. Significant postnotching increases in current velocity were found below notches when the effects of changing river stage were removed. An increase in the proportion of sand in the substrate of the side channel appeared to be related to notching. Benthos populations in the main channel border (near wing dams) generally increased significantly from the prenotching to postnotching period due to severe reductions in benthos populations by unusually high discharge in July 1978 (prenotching period) and subsequent recovery in postnotching during 1979 and 1980. High gravel content in the substrate and high benthic invertebrate densities below the notch at wing dam 26 in the fall of 1979 may have been a localized effect of increased flow caused by notching. Benthos did not increase significantly in the side channel after notching, probably because of the increase in sand which may have been caused by notching. There were no appreciable effects of notching on fish populations.

THE QUANTITY AND NUTRITIVE QUALITY OF *VALLISNERIA AMERICANA* IN NAVIGATION POOL NO. 9 OF THE UPPER MISSISSIPPI RIVER

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Vallisneria americana Michx. was sampled from May 1980 to October 1981 to determine annual fluctuations in biomass and productivity. The nutritive quality of all anatomical structures were also determined. The entire winter biomass was composed of winter buds. In contrast, 67.58% of the total biomass was composed of leaves by late June. Other organs (fruits, flowers, rootstocks, stolons, winter buds, and peduncles) made up ca. 32.5% of the total biomass by 1 September. The maximum production rate of 3.25 $g \cdot m^{-2} \cdot d^{-1}$ was observed during mid to late July and the maximum biomass of 217.29 g dry weight $\cdot m^{-2}$ (ca. 174.64 g organic matter $\cdot m^{-2}$) occurred on 1 September.

Nutrient analyses of plant organs were done throughout the year. Crude protein (total nitrogen x 6.25) for all organs ranged from 6.31-24.5% of the dry weight; leaves contained the highest yearly average of 16%. Digestible non-cell wall materials were highest for fruits, flowers, and winter buds and were lowest for rootstocks and leaves. Ash content was minimal in winter buds but reached a maximum of 38.72% of the dry matter in foliage harvested in mid-July. Caloric content ranged from approximately 3-4.5 Kcal $\cdot g^{-1}$. *Vallisneria* is similar to alfalfa in crude protein and non-cell wall material but has higher ash and moisture content. All parts of *Vallisneria* are eaten by waterfowl but winter buds, leaves, and rootstocks are the most frequently consumed organs.

TRANSPORT OF AQUATIC FAUNA FROM BACKWATERS TO THE MAIN CHANNEL OF THE MISSISSIPPI RIVER

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Prevailing ecological wisdom suggests that backwaters are more productive than main channel habitats. Few studies have really addressed the magnitude of this difference, or the exchange between these habitats. Findings from 1981 studies suggest that the productivity of the main channel and main channel border sites may be directly linked to the presence or absence of backwaters upstream from these sites. Drift from side channels that were fed by productive backwaters averaged 10X the drift from adjacent main channel sites.

FRESHWATER DRUM SPAWNING AND FECUNDITY IN THE UPPER MISSISSIPPI RIVER

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One hundred freshwater drum ovaries from 1981 collections were examined to provide spawning and fecundity information for the long-term fisheries monitoring program at the Quad Cities Nuclear Power Station. Objectives were to estimate freshwater drum fecundity in the Upper Mississippi River, relate sexual maturity to size or age, and determine the specific spawning period in Navigation Pool 14.

The mean fecundity estimate for selected fish was 85,800 ova per female. The total estimated number of ova showed no relationship with fish length or weight, but there was an apparent relationship with age. Mean number of ova for a given age group increased with age.

Female freshwater drum in Pool 14 may become sexually mature at age 4, but females age 5 and older comprised over 95% of the 100 females representing the spawning population. Spawning occurred during a 10 week period starting in late May and extending through the first week of August. Peak spawning activity occurred prior to July 1.

THE POTENTIAL EFFECTS OF EXPANDING MACROPHYTE DEVELOPMENT ON CHANNEL BORDER BENTHIC COMMUNITIES

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Silt accumulation decreases the depth of channel border areas in lower reaches of navigation pools on the Mississippi River. This can cause an increase in the size and distribution of aquatic plant beds. To determine the extent of change in benthic invertebrate communities as a result of larger areas of macrophytes, three transects were established from the shore to the center of the navigation channel in lower reaches of Pool 19. Ten sampling stations were located along each transect and replicate 0.09 m^2 ponar dredge samples were taken monthly during 1981. Invertebrate communities could be characterized in relation to plant bed structure with little overlap between the communities. Differences in invertebrate community structure were found between unvegetated channel boarder areas with a sphaeriid-Hexagenia community and the floating-emergent plant areas with gastropod-oligochaet communities. Substrates in areas of plant beds contained high organic matter and were heavier (higher silt and clay content), and thus may not provide suitable habitat for fingernail clams and mayflies.

SEDIMENTATION RATES AND STANDING STOCK ESTIMATES IN SELECTED SLOUGHS OF POOL 14 OF THE MISSISSIPPI RIVER

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Sedimentation rates in two selected sloughs in Pool 14 of the Mississippi River were estimated. One slough which apparently receives high volume of flow during periods of elevated river stages had a maximum water depth of about 0.3 m at normal pool elevation. The other location which apparently does not receive these high water flows had a maximum water depth of 0.6 m at normal pool elevation. Sediment samples were analyzed for cesium-137 content. Results indicated that since 1954, up to 1.2 m of sediment have been deposited in the shallower slough and up to 0.6 m in the deeper site.

Standing stock estimates of fish were made at these two sloughs and at a third slough having a maximum water depth of 2.4 m at normal pool elevation. This additional site was a cove that had been dredged. Rotenone surveys resulted in estimates of 96 kg/ha, 502 kg/ha and 620 kg/ha at the 0.3 m, 0.6 m and 2.4 m depth sloughs, respectively. These results indicate an apparent correlation between the lower standing stocks and the shallower slough. Sedimentation has resulted in the decline of the standing stock in this habitat and further reductions of standing stocks can be expected in the future for this habitat if sedimentation continues.

SPATIAL AND TEMPORAL DISTRIBUTION OF ICHTHYOPLANKTON IN POOL 7 OF THE UPPER MISSISSIPPI RIVER

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Ichthyoplankton were collected at least twice a month in Navigation Pool 7 of the Upper Mississippi River as part of an effort to document nursery use patterns and early life histories of various commercially and ecologically important fishes in this severely modified riverine system. Although as many as 66 species of adults have been reported for the area (33 considered common) only 17 species have been identified from the larval collections. Percicthyids, percids, catostomids, and some centrarchids were predominant; cyprinids, sciaenids, clupeids, and other centrarchids became more abundant later. The majority of larvae collected in the river proper were found in those sites near main channel areas with access to major expanses of shallow backwaters. This was especially true in early spring when flooded tributaries flushed marsh areas. Later in the season collections from the lower pool and lake yielded the majority of larvae. Drum and gizzard shad predominated in these samples. There was distinct periodicity in numbers of larvae found in diel collections. The pattern was noticeably different in species composition and sampling locations within a transect. Drum were more abundant near the surface at midnight than during the day. Carp were most abundant at dusk, while all other cyprinids were most abundant during dusk and dawn than at any other time. Shad also exhibited a slight numerical increase at dusk. Although total numbers of larvae collected were greatest at dusk in main channel (surface and bottom) and main channel border habitats, backwater habitats had greatest numbers of larvae during the midnight and dawn collections.

OBSERVATIONS OF FOOD PARTITIONING IN THREE SPECIES OF JUVENILE FISHES IN A BACKWATER HABITAT OF THE UPPER MISSISSIPPI RIVER

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Over 100 juvenile fishes have been examined for food habits as part of a preliminary study of resource partitioning by juvenile fishes in backwater areas. Noticeable differences in stomach contents existed in the 3 species examined to date. Largemouth bass (45 mm T.L.) fed primarily on amphipods and cladocerans (52% and 33% by number, respectively). Ostracods (1%), chrionomids (10%), and other aquatic insects (5%) were also present in stomachs. All individuals examined contained at least one cladoceran, while 83% consumed amphipods, 87% chironomids, and 60% other aquatic insects. Black crappies (31 mm T.L.) ate similiar items, but in different proportions. Cladocerans numerically predominant in the diet (68%), while amphipods (10%), and chironomids (14%) made up minor fractions. Ostracods (2%), cyclopoid copepods (4%), and other aquatic insects (2%) were minimally represented. Cladocerans were found in 96% of the stomachs examined. Chironomids, amphipods, and copepods followed in frequency of occurrence (74%, 58%, and 47%, respectively). Although both species ate chironomids, black crappies consumed smaller individuals. This is clearly a function of differences in mouth size of the juveniles of these two species. Northern pike differed from both of the above species in that juveniles are primarily piscivorous. Young darters were the predominant item found in the guts both by frequency of occurrence (64%) and volume, but not by numbers (47%). Cladocera were the most abundant overall (55%). Amphipods, aquatic insects, and isopods also were common by number (14%, 21%, and 19%, respectively). These three fish species are of considerable sport and ecological importance. The juveniles overlap temporally in their distributions within backwater areas of the Upper Mississippi River. They apparently reduce competition primarily by partitioning prey by size. Further analyses are necessary to determine the details of their association within the system.

PRELIMINARY INVESTIGATIONS OF HOST SPECIFICITY IN THE ENDANGERED MUSSEL, LAMPSILIS HIGGINSI AND ITS CONGENER, L. VENTRICOSA

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Preliminary host specificity data on the higgins' eye mussel Lampsilis higginsi have been analyzed. This species is the only mussel currently found in the Upper Mississippi River included on the Federal Endangered Species List. Similar data were collected on its congener, L. ventricosa (pocketbook clam). Parasitic clam larvae (glochidia) require an intermediate fish host to complete their life cycle. Ten species of fish were treated with L. higginsi glochidia, and eight species were treated with L. ventricosa glochidia. In both host specificity experiments, representatives of the families Cyprinidae, Ictaluridae, Centrarchidae, and Percidae were tested as hosts. A catostomid, salmonid, and sciaenid were also tested in the L. higginsi study. In both studies, catfishes and minnows failed to become infected. Lepomid species stayed infected approximately 3 days with higgins' eye glochidia and up to 12 days with pocketbook glochidia. Micropterus sp. were infected up to 10 days with pocketbook glochidia and up to 35 days with higgins' eye glochidia. Suckers failed to become infected with higgins' eye glochidia; rainbow trout and freshwater drum remained infected for only 4 days. Maximum length of glochidial infection was attained with Stizostedion vitreum for both higgins' eye and pocketbook clams. Although transformed juveniles were not obtained in any of the tests to date, several of the species of fish tested may be acceptable hosts for the endangered clam and its congener. Glochidial longevity without host attachment was tested also. Larvae were placed in a 1-gal aerated tank. A sodium chloride test was used to check viability with time. Eighty percent of the glochidia were initially viable (i.e., responded to the salt treatment by snapping shut). After 24 h, only 70% were responsive while after 48 h, 50% were responsive. After 72 h, no glochidia demonstrated viability.

A WATER QUALITY AND SEDIMENT CONTAMINANT SCREENING SURVEY IN THE MISSISSIPPI RIVER AT ST. LOUIS, NOVEMBER, 1980 TO SEPTEMBER, 1981

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Quarterly water samples and one set of bottom sediment samples were collected from the Mississippi River at St. Louis, to identify ambient water quality and any detectable impacts of wastewaters upon water quality in the study area. Water samples were collected from four, river mile transects in November, 1980, and from five transects in March, June, and September, 1981, with three sites per transect. A total of 57 water samples were collected within the 16-mile Mississippi River segment adjacent to St. Louis. Four field parameters, 14 non-metal constituents, 22 metals and metalloids, and several organic contaminants were analyzed in each water sample. Two samples of bottom sediment were collected on each river mile transect and analyzed for several chlorinated organic contaminants. Four water samples were collected on each of three dates, in the vicinity of a municipal wastewater discharge known to contain industrial wastes. These samples were analyzed for a broad range of parameters.

Results of this survey are presented, showing patterns in water quality, concentrations of contaminants, and apparent impacts of municipal wastewaters. Concentrations of nutrients, fecal coliform bacteria, and other water quality constituents were measureably impacted by wastewaters. Many metals and organic contaminants were detected in water samples. Contaminants found in sediment samples included lead, mercury, and polychlorinated biphenyls (PCB's).

AN EVALUATION OF THE ICHTHYOPLANKTON DRIFT IN THE VICINITY OF DAIRYLAND POWER COOPERATIVE'S ELECTRICAL GENERATING FACILITIES ON POOL 5 OF THE UPPER MISSISSIPPI RIVER NEAR ALMA, WISCONSIN

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Weekly ichthyoplankton drift sampling was conducted during 1981 to characterize the nature of the larval fish drift in Pool 5 of the Upper Mississippi River near Dairyland Power Cooperative's Alma, Wisconsin electrical generating site. Emerald shiner (Notropis atherinoides), gizzard shad (Dorosoma cepedianum), and freshwater drum (Aplodinotus grunniens) comprised 47.8, 19.5, and 13.7 percent of the drift, respectively. The ichthyoplankton drift began in late April and terminated in mid-August with the maximum drift (1.051 fish/m^3) occurring in late June. Analysis of vertical distribution indicated that emerald shiner drifted near the surface while freshwater drum drifted closer to the bottom. Gizzard shad and percids were concentrated in middle and bottom samples. Catostomids and white bass (Morone chrysops) were rather evenly distributed throughout the water column. Examination of water temperature and time of initial occurrence showed that percids were the first (12.2°C, late April) and cyprinids (probably Pimephales sp.) were among the last (24.2°C, early August).

EVALUATION OF POLYCHLORINATED BIPHENYLS IN FISH FILLETS FROM LAKE WINONA

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Four species of fish were collected by use of electrofishing techniques from each end of Lake Winona, T107 R7W, Winona, Minnesota in October 1979 for the purpose of examining the edible fillet tissue for presence of polychlorinated biphenyls (PCB's). The species collected from the west end of the lake included bluegill (Lepomis macrochirus), black crappie (Pomoxis nigromaculatus), largemouth bass (Micropterus salmoides), and northern pike (Esox lucius). The species collected from the east end of the lake included bluegill, largemouth bass, walleye (Stizostedion vitreum) and carp (Cyprinus carpio). Pooled samples of skinless fillets of each species from each end of the lake were analyzed for PCB's by electron-capture gas chromatography. Final estimation of PCB content in these pooled species samples ranged from 0.019 parts per million (ppm) in black crappie to 0.031 ppm in largemouth bass from the west end of the lake and 0.024 ppm in bluegill to 0.083 ppm in walleye from the east end of the lake.

ANALYSIS OF UPPER MISSISSIPPI RIVER SYSTEM RELATIONSHIPS BETWEEN SELECTED PHYSICAL, BIOLOGICAL, AND NAVIGATION VARIABLES

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Statistical correlations were calculated for Upper Mississippi River System (UMRS) physical, biological and navigation variables to generate a system-wide perspective of their interrelationships. Physical variables included those related to stream morphology, flow, sediment, water quality, and ice conditions. Biological variables included submergent, emergent, and floating leaf vegetation, mussels, sport and commercial fish, herons, and egrets. Navigation variables included bank protection, wing dams, commercial terminals, fleeting areas, recreational boating capacity, commercial traffic and dredging. Most of the data values compiled were representative of UMRS navigation pools or reaches of similar size.

Clear relationships between habitat surface areas and biological abundance variables required that other correlations be calculated using density or diversity variables. The presence of several variables that exhibited longitudinal gradients along the Mississippi River complicated the identification of cause and effect relationships between physical or navigation variables and biological variables. High aquatic plant, commercial fish harvest, heron and egret densities were significantly correlated ($P \leq 0.05$) with high marsh or non-channel habitat percentages. Few significant correlations between specific fish group harvests and habitat percentages were observed that could not be explained by the known distribution of the fish. Potential cause and effect relationships were indicated between high dredging activity and low buffalo, sturgeon and paddlefish densities and mussel diversity. While significant correlations between high commercial traffic levels and several low biological density variables were observed, more sophisticated statistical analysis is required to determine which of these result from cause and effect relationships.

A STUDY OF THE PHYCOPERIPHYTON ON GLASS SLIDE SUBSTRATES WITH A COMPARISON TO NATURAL SUBSTRATES

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Periphytometers with glass slide substrates were used to develop two years of baseline data on phycoperiphyton community structure in Navigation Pool No. 5 of the Upper Mississippi River.

Two distinct communities were identified, a spring-fall community and a summer community (July through October). During spring and fall the phycoperiphyton community was three-dimensional, with *Melosira varians*, *Gomphonema olivaceum*, and *Diatoma vulgare* as the common taxa. The summer community was dominated by *Cocconeis placentula* var. *euglypta* and was essentially two-dimensional. The summer community apparently did not develop into a three-dimensional community due to scouring action of waves within the main channel. Epiphytic phycoperiphyton on *Cladophora* sp. growing close to shore along the main channel were examined to determine community structure and dominant species. In general, communities from the area affected by severe wave action were similar to communities on glass slide substrates throughout the year, whereas epiphytic communities from below the area of severe wave action were consistently three-dimensional. These results indicate that natural epiphytic communities may be affected by wave action in a way similar to glass substrate communities.

INVESTIGATIONS AND COMPARISONS OF THEORIES DIRECTLY RELATED TO THE CAUSE OF BED FORMS

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The objective of this study was to investigate the relationship of different flow parameters to bed forms. The results of this prototype study were compared with theories previously presented by Simons, Richardson, Albertson, and Dawdy.

Data for this study was obtained through the cooperation of the U.S. Army Corps of Engineers, St. Louis District and the Institute of River Studies at the University of Missouri-Rolla. The data utilized was taken from the Mississippi River at Mile 174, and consisted of and water surface slopes, discharge, and longitudinal bed profiles one thousand feet long spaced at one hundred foot intervals across the river.

The study revealed that many of the theories which appeared valid from flume data are not substantiated by the data obtained from the Mississippi River. A need for new definitions or new terms describing bed forms in the upper regime also resulted from the comparisons.

PCB's AND OTHER CHLORINATED HYDROCARBONS IN HERON AND EGRET EGGS FROM THE UPPER MISSISSIPPI RIVER

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Analysis of great blue heron (Ardea herodias) and great egret (Casmerodius albus) eggs collected in 1978 from a large breeding colony near Fountain City, Wisconsin, indicated that PCB contamination was widespread. Representative levels of PCB ranged from approximately 0.8 ppm to 5.8 ppm. DDE and other chlorinated hydrocarbons were also found to be present.

Nest counts taken annually in the colony beginning in the winter of 1975-76 showed a decline in colony size. Total nests for the years 1975 through 1980 respectively were 587, 565, 492, 463, 335, and 279.

An observation platform was used to determine clutch sizes and hatching success. Mean clutch size for the great blue heron was 3.23 eggs/nest and 3.51 eggs/nest in 1977 and 1978 respectively. Mean clutch size for the great egret was 3.25 eggs/nest and 3.44 eggs/nest in 1977 and 1978 respectively. Great blue heron hatching success was 88% in 1977 with 2.84 young hatched/nest and 84% in 1978 with 2.95 young hatched/nest. Great egret hatching success was 91% in 1977 with 2.96 young hatched/nest and 87% in 1978 with 2.99 young hatched/nest.

Mean thickness index for great blue heron eggshells was 1.95 in both 1977 and 1978. Mean thickness index for great egret eggshells was 1.48 in 1977 and 1.50 in 1978.

THE CASE FOR GENE BANK CONSERVATION IN THE UPPER MISSISSIPPI RIVER: AZOLLA (POLYPODIOPHYTA: AZOLLACEAE) AND BIOLOGICAL NITROGEN-FIXATION

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Azolla, a moss-like, aquatic fern has strong value as an economic plant. It is able to double its dry weight biomass in two days, and it can fix atmospheric nitrogen through a symbiotic relationship. Azolla is used as a biological nitrogen source in tropical countries to support rice production. Recently, it has been demonstrated that different strains of Azolla excel as a green manure, plant source for biomass conversion, mosquito control and a high nitrogen food supplement for fish, poultry, and cattle production. Most studies have focused on southern strains of Azolla in tropical climates. In North America, Arkansas is the leading rice producing state, but does not have a tropical climate. Strains with cold hardiness and different photoperiods are needed to enhance rice production in Arkansas. The upper 15 pools of the Mississippi River support numerous, large populations of Azolla which are the northernmost populations in North America and are exposed to severe extremes in winter and summer climates. These populations provide a significant gene bank for survey and implementation into temperate-grown rice production in the southern United States. Investigators, planners, and managers of the Upper Mississippi River need to become aware of the economic importance of Azolla and of the importance of the river ecosystem as a gene bank which must be conserved.

THE MITIGATION AND ENHANCEMENT HANDBOOK FOR THE UPPER MISSISSIPPI RIVER SYSTEM (UMRS) AND OTHER LARGE RIVER SYSTEMS

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The Mitigation and Enhancement Handbook for the Upper Mississippi River System (UMRS) and other large river systems provides information on techniques which can eliminate, reduce, or minimize the negative impact of man's activities, particularly those related to navigation, on such river systems. The Handbook will help resource managers concerned with large river systems to implement sound environmental programs.

The treatment of each technique or group of techniques includes: 1) nature of situation to be mitigated or enhanced, 2) description of technique(s), 3) adverse/beneficial environmental and resource impacts, 4) costs, and 5) elevation of technique(s) for use on the UMRS. The techniques are addressed under four primary considerations, namely: 1) Bank Stabilization; 2) Dredging/Dredged Material Disposal, 3) Fisheries Management, and 4) Wildlife Management. Techniques have been grouped by function, rather than structure; thus, some structures are discussed in several contexts. For example, gabions are discussed for use as revetments, river training structure, and breakwaters.

The major techniques covered under Bank Stabilization include riprap, revetments, bulkheads, river training structures, breakwaters, vegetation, chemical soil stabilizers, erosion control matting, filter fabrics, island creation, berm creation/beach enrichment, water level control, and boat traffic regulation. The discussions on Dredging/Dredged Material Disposal consider dredges, dredging methods, and dredged material disposal. The following techniques are covered under Fisheries Management: fish attractors; spawning reefs; nursery ponds, coves and marshes; fish screens and barriers; fish passage; water control structures; management of water levels and flows; wing dam modification; side channel modification; aeration techniques; control of aquatic plants; and manipulation of fish populations. Artificial nest structures, island creation/development, marsh creation/development, greentree reservoirs/mast management, vegetation control, water level control, and revegetation are discussed under Wildlife Management.

INVESTIGATION OF EFFECTS OF NAVIGATION DEVELOPMENT AND MAINTENANCE ACTIVITIES ON HYDROLOGIC, HYDRAULIC, AND GEOMORPHIC CHARACTERISTICS

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The general geomorphic, hydrologic, and hydraulic characteristics of the Upper and Middle Mississippi River Systems are discussed. Changes in the river's characteristics are related to navigation development and maintenance activities in the river systems. The Upper Mississippi from St. Paul, Minnesota to Alton, Illinois consists of a series of 26 pools separated by locks and dams. The Middle Mississippi is free-flowing; however, it has undergone extensive improvements for navigation purposes. Human activities have affected the Upper and Middle Mississippi River systems in different ways. Man-induced physical changes in the Upper Mississippi River System are discussed and potential problem reaches in terms of navigation impacts are identified. Effects of navigation improvements on both the Upper and Middle River systems are compared and contrasted, and the different geomorphic, hydrologic, and hydraulic changes in the two segments are discussed.

PADDLEFISH MOVEMENT AND HABITAT USE IN THE UPPER MISSISSIPPI RIVER

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The paddlefish is an important sport and commercial fish species in the Upper Mississippi River. Paddlefish movement and habitat use were investigated by radio-telemetry. Fish were surgically implanted with 49 MHz radio transmitters and released at capture site in Pool 13. Radio-tagged fish measured 68 to 96 cm, eye to fork length, and weighed 4 to 18 kg. Seven paddlefish were monitored during the summer of 1980, and ten fish were tracked through the spring and into the summer of 1981. Tracking was conducted primarily by boat, with a single search by aircraft for lost fish in 1981. Physical characteristics of the habitat measured at telemetry location sites were: water depth, current velocity, water temperature, bottom contour, and proximity to navigation improvement structures.

Paddlefish exhibited great mobility, especially during the spring months. Individual linear range varied from 12.5 to 104.6 km during the study period. Interpool movement through navigation dams was observed. Group movement upstream through Lock and Dam 12 occurred when dam gates were raised during a high-water period in spring, 1981. Movement downstream through Lock and Dam 12 was accomplished when dam gates were partially closed. Movement from and subsequent return to specific areas suggested recognition of particular habitats. Main channel border and tailwater habitats were utilized most frequently, although telemetry locations were also made in backwater, main channel, and side channel habitats. Association with wing dams was observed.

ACCRETION PATTERNS BEHIND DIKES ON THE MIDDLE MISSISSIPPI RIVER

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The data to be presented will be extracted from the engineering phase of the GREAT III study entitled "The Influence of Regulating Structures on Fish and Wildlife Habitat."

During the past 10 months, 4 sets of soundings made with a recording fathometer have been made of 5 ranges parallel to and downstream of 8 different dikes located on the Middle Mississippi River between river mile 95 and 115.

The data obtained from the fathometer is utilized in contouring on 2 ft intervals the bed of the river downstream of each dike. This information coupled with photographs of the same areas show the types of accretion patterns that exist around dikes of different design and dikes subjected to different flow characteristics.

A PRELIMINARY EVALUATION OF BACKWATER AND SIDE CHANNEL UTILIZATION BY COMMON FISHES IN POOL 7

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Distributional patterns of habitat utilization by fishes common in Pool 7 were determined from March to July, 1981. Fish were sampled with experimental gill nets and hoop nets in side channels and backwater habitats at four sites between river miles 704-710. Paired hoop nets and gill nets were set simultaneously in both habitat types for 24 hours. Twenty-six sets were made during the study period. Seven hundred seventy fish representing 33 species were caught. There was no significant difference in the number of different species caught in side channel and backwater areas. Significantly more individual fish were caught in backwater habitats than in side channels. These results may indicate greater habitat diversity in backwater areas than in side channel areas.

EVALUATION OF CONTINUOUS WALLEYE AND SAUGER FISHING IN POOL 4 OF THE MISSISSIPPI RIVER

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Continuous fishing for walleyes and saugers in the Mississippi River has been a concern of local anglers since the initiation of continuous fishing in 1967. Anglers fear that too many fish and too many large fish are caught during spring (March and April), especially in the tailwaters of Lock and Dam 3. An evaluation of the effects of the continuous fishing on the walleye and sauger populations of Pool 4 indicates that these populations have not shown symptoms of excessive harvest and the spring fishery cannot be considered successful for the angler. The walleye population is characterized by adequate reproduction, a high mortality rate, fast growth, early maturity and an acceptable exploitation rate. The sauger population parameters are similar except for apparent population fluctuations.

A PRACTICAL FUNDING APPROACH FOR ON-GOING STUDY, MONITORING, AND MANAGEMENT OF THE FISH AND WILDLIFE OF THE UPPER MISSISSIPPI RIVER

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The Great River Environmental Action Team (GREAT) reports and the Basin Commission's Master Plan all call for extensive and prolonged biological and biologically related work to be pursued on the "navigable" portion of the Upper Mississippi River, including research, monitoring and management. The prospects for funding for such work, particularly for a prolonged period, are not good in light of historical attitudes and present fiscal approaches in the Congress. There is, however, an approach to funding the kind of biologically oriented work proposed by the GREAT and Master Plan which is possible, practical, and should have good support amongst all the concerned agencies. The Federal Aid in Wildlife and Fish Restoration programs, known widely as P-R and D-J, provide for cooperative projects amongst states having common wildlife management interests. Such a cooperative project amongst the UMRCC states could assure dependable and long range funding for many of the proposed studies, monitoring projects, and restoration projects.

The P-R and D-J programs were developed in the 1930s and 1940s to provide a consistent funding source to state fish and game agencies for wildlife and fish restoration and conservation work. In 1981, P-R contributed $13 million to the UMRCC states' wildlife work and $5 million to their collective fisheries work. Decisions on where this money goes is primarily a state matter. Though none of the money now supports Upper Mississippi River work, it could, particularly if proposals in Congress to expand the P-R and D-J "user-fee" tax are adopted. The Federal Aid office and state Federal Aid Coordinators are available to assist in developing such a cooperative project.

RELATIVE UTILIZATION OF MISSISSIPPI RIVER HABITATS AS FISH NURSERY AREAS

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Eight specific shallow-water habitats in backwater, side channel, and main channel border areas of the Mississippi River were sampled for young-of-the-year utilization during 1980 and 1981. Young-of-the-year of 42 species were documented. Species diversity index and species richness exhibited positive correlations with percent silt in the substrate ($r = 0.48$ and 0.71, respectively) and strong negative correlations with current velocity ($r = -0.73$ and -0.91, respectively). Over one-third of the species were found at only one or two sites due to their high degree of habitat specificity and/or uncommon status. The more cosmopolitan species also exhibited varying degrees of preference for nursery habitat, with distribution between sites differing significantly for many. Dredge spoil areas were the poorest nursery habitat, but were utilized by channel catfish. Low-current and lentic environments with predominantly silt substrates in backwater and main channel border areas were the most important nursery habitat. Such sites, when combined with the presence of rooted aquatic vegetation, appeared to be critical nursery habitat for several important sport species.

EFFECTS OF THE MISSISSIPPI RIVER SYSTEM ON GROUND-WATER FLOW IN SOUTHEASTERN MINNESOTA

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The Mississippi River and its principal tributaries in Minnesota are largely responsible for present-day ground-water-flow patterns in bedrock aquifers that underlie the southeastern part of the state. This river system is the result of multiple glaciations during the Pleistocene age; it has incised the deepest bedrock aquifers in the area. Large volumes of glacial melt water, particularly from drainage of Glacial Lake Agassiz, caused the Mississippi River to incise a channel as deep as 700 feet into the bedrock. Channel incision accelerated headward erosion of tributary streams, which removed the upper bedrock units from a large area adjacent to the river system.

Potentiometric-surface maps for the Upper Carbonate, St. Peter, Prairie du Chien-Jordan, Ironton-Galesville, and Mount Simon-Hinckley aquifers indicate that ground water presently flows toward the Mississippi River and its major tributaries. The St. Croix and Mississippi Rivers along the Minnesota-Wisconsin boundary constitute a regional discharge boundary for ground-water flow. Locally, flows are to the Minnesota, Vermillion, Cannon, Zumbro, Whitewater, and Root Rivers.

Ground-water mounds are present along a 25-mile strip adjacent to the Mississippi River where the near-surface Decorah-Platteville-Glenwood confining bed has been removed by headward erosion. The St. Peter and Prairie du Chien-Jordan aquifers subcrop in this area beneath drift generally less than 20 feet thick, and contain potentiometric mounds that are as much as 90 feet above the regional potentiometric surfaces for these aquifers. Head distribution around the mounds indicates a locally complex pattern of flow where radially flow from the mounds moves in directions other than toward the Mississippi River.