



Mississippi
River
Research
Consortium

14th Annual Meeting
La Crosse, Wisconsin



Mississippi River Research Consortium

14th ANNUAL MEETING

April 2 and 3, 1981 --- Ramada Inn
La Crosse, Wisconsin

Program Summary:

Technical Papers - 34
Thursday Night Presentation - The Trempealeau National Wildlife Refuge
" One Man's Wilderness "
Friday Afternoon Debate - Who Owns the River?

Program Arrangements:

Michael J. Vanderford - MRRC President, U.S. Fish and Wildlife Service, Twin Cities
Dr. Ronald Rada - River Studies Center, University of Wisconsin-La Crosse
Dr. Miles Smart - River Studies Center, University of Wisconsin-La Crosse
Gloria Wiener - River Studies Center, University of Wisconsin-La Crosse
Dr. Thomas Claflin - River Studies Center, University of Wisconsin-La Crosse

Past Meetings:

	<u>Place</u>	<u>President</u>
1st 1968	St. Mary's College, Winona	Brother George Pahl
2nd 1969	Wisconsin State University, LaCrosse	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, Ill.	Dr. Jacob Verduin, SIU
9th 1976	St. Mary's College, Winona	Dr. David McConville
10th 1977	Winona State University, Winona	Dr. Dennis Nielsen
11th 1978	University of Wisconsin - LaCrosse	Dr. Ronald Rada
12th 1979	cancelled	Dr. Edward Cawley
13th 1980	Loras College, Dubuque	Dr. Edward Cawley
14th 1981	Ramada Inn, LaCrosse	Michael Vanderford

PROGRAM

MISSISSIPPI RIVER RESEARCH CONSORTIUM

Co-sponsored by:

The River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI
and
The U. S. Fish and Wildlife Service, St. Paul, MN

Wednesday, April 1, 1981
Drake Room

4:00 - 8:00 p.m. Registration Desk Open

Thursday, April 2, 1981
Teal and Drake Rooms

8:00 a.m. - 4:00 p.m. Registration Desk Open

8:00 - 8:20 a.m. Electrical Output Calibration of the Coffelt
Electroshocker Model VVP-15 by Oscilloscope.
G. Lauer, D. McConville, and J. Haas

8:20 - 8:40 a.m. Channel Dwelling Fishes of Pool 9, Upper Mississippi
River. W. A. Hubert and D. N. Schmitt

8:40 - 9:00 a.m. Impingement of Fish at Dairyland Power Cooperative's
Genoa Site. M. McInerny

9:00 - 9:20 a.m. Species Composition of Hoopnetting Catches from Main
Channel Border and Main Channel Habitats of Pool 26,
Mississippi and Illinois Rivers. J. Broughton and
K. S. Lubinski

9:20 - 9:40 a.m. The Aquatic and Floodplain Vascular Flora of the
Mississippi and Illinois Rivers in Lower Pool 26.
M. C. Reese

9:40 - 10:00 a.m. Diel Drift and Abundance of Benthic Macroinvertebrates,
Mississippi and Illinois Rivers, Pool 26. J. C.
Hutton, H. H. Seagle, Jr., R. V. Anderson, and
D. Leibig

10:00 - 10:20 a.m. BREAK (coffee provided)

10:20 - 10:40 a.m. Studies to Assess the Physical Impacts of Navigation.
J. R. Adams and M. Demissie

10:40 - 11:00 a.m. Waves Generated by River Traffic. M. Demissie,
J. R. Adams, R. Allgire and S. Osakada

11:00 - 11:20 a.m. Field Methods for Measuring the Lateral Movement of
Suspended Sediments in Rivers Associated with the
Movement of Commercial Vessels. A. P. Bonini,
D. J. Kissner, and D. K. Davie

11:20 - 11:40 a.m. Lateral Movement of Sediment Due to River Traffic.
N. G. Bhowmik, M. Sexton, and J. Guo

11:40 - 12:00 noon Water and Sediment Inputs to Selected Side Channels
Associated with River Traffic. M. T. Lee, W. C.
Bogner, and W. P. Fitzpatrick

12:00 - 1:00 p.m. LUNCH (Buffet, Ramada Inn)

- 1:00 - 1:20 p.m. Analysis of Hydrological, Hydraulic, Sedimentation, Morphological and Thermal Changes in the Kizhuyak and Terror Rivers Associated with Terror Lake Hydroelectric Project. D. B. Simons, R. M. Li, and Y. H. Chen
- 1:20 - 1:40 p.m. A Geomorphic and Mathematical Model Study of Pools 4 through 8 in the Upper Mississippi River System. D. B. Simons and Y. H. Chen
- 1:40 - 2:00 p.m. Side Channel Discharge as a Function of Slope in Navigation Pool No. 9. T. O. Claflin, R. G. Rada, M. M. Smart, and D. Nielsen
- 2:00 - 2:20 p.m. Flow Rates to Backwaters of the Mississippi River. J. W. Eckblad
- 2:20 - 2:40 p.m. Investigation of the Effects of Chippewa River Erosion and Silt Reduction Measures. Y. H. Chen and D. B. Simons
- 2:40 - 3:00 p.m. BREAK (coffee provided)
- 3:00 - 3:20 p.m. Reproduction and Feeding Habits of the Great Blue Heron Ardea herodias at Mississippi River Mile 609.25. K. S. Schroeder
- 3:20 - 3:40 p.m. A Report of the Ciconiiformes and Charadriiformes Visiting the Commer's Chute Sandbars of Northwestern Lake Onalaska. F. Z. Leshner
- 3:40 - 4:00 p.m. Quantitative Analysis of Naiad Mollusks from the Prairie du Chien, Wisconsin, Dredge Material Site on the Mississippi River. M. E. Havlik and L. L. Marking
- 4:00 - 4:20 p.m. Investigations of Declines in Fingernail Clam (Musculium transversum) Populations in the Illinois River and Pool 19 of the Mississippi River. M. J. Sandusky, R. E. Sparks, and A. A. Paparo
- 4:20 - 4:40 p.m. A First Hand Look at the Bottom of the Mississippi River. D. J. Heath
- 4:40 - 5:00 p.m. A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River. R. E. Duncan
- 7:00 - 7:30 p.m. The Trempealeau National Wildlife Refuge - "One Man's Wilderness". B. Drazkowski, Comptroller, Saint Mary's College, Winona, MN
- 7:30 p.m. SOCIAL GATHERING - Ramada Inn (beer, soft drinks, hors d'oeuvres provided - cash bar available)

Friday, April 3, 1981
Teal and Drake Rooms

- 8:00 a.m. - 12:00 noon Registration Desk Open
- 8:00 - 8:20 a.m. Investigations of Dredged Material Disposal Sites in Pools 12, 13, and 14. M. E. Harris, R. M. Miller, M. Cornelius, D. Kunkel, and T. Williams
- 8:20 - 8:40 a.m. Chemical Characteristics of Dredge Material from Ten Sites on the Upper Mississippi River. V. K. Dawson and J. L. Allen
- 8:40 - 9:00 a.m. Biological Activity of Dredge Material from Ten Sites on the Upper Mississippi River. J. J. Rach
- 9:00 - 9:20 a.m. An Investigation of Lake Pepin Bottom Sediments/ Characteristics (Particle Size, Organic Content, Heavy Metals, TKN, TP). P. A. Bailey and R. G. Rada

9:20 - 9:40 a.m.	Longitudinal Distribution of Trace Elements in Two Species of Fish in the Upper Mississippi River. J. G. Wiener, G. A. Jackson, and T. W. May
9:40 - 10:00 a.m.	A Hydrologic Simulation for Predicting Nonpoint Source Pollution. R. M. Li, D. B. Simons, and K. G. Eggert
10:00 - 10:20 a.m.	BREAK (coffee provided)
10:20 - 10:40 a.m.	Continuous Automatic Monitoring of the Upper Mississippi River in the Twin Cities Area. H. A. Boyer
10:40 - 11:00 a.m.	Start-up of a Bioassay Trailer for Monitoring Waste-Water Effluent Impacts on the Mississippi and Minnesota Rivers. D. K. Johnson
11:00 - 11:20 a.m.	An Investigation of Main Channel Border Habitat of Pool 5A, Upper Mississippi River. D. D. Anderson, D. B. Wilcox, and R. Whiting
11:20 - 11:40 a.m.	Land Cover and Land Use Changes on the Upper Mississippi River Floodplain due to the 9-Foot Channel. K. N. Olson and M. P. Meyer
11:40 - 12:00 noon	Master Plan for Recreation and Resource Management, Upper Mississippi River. J. N. Holleran
12:00 - 12:20 p.m.	Regional List of Vascular Plants of Biological Concern in the Five States of the Upper Mississippi River. J. H. Peck
12:20 - 1:30 p.m.	LUNCH (Buffet, Ramada Inn)
1:30 - 2:00 p.m.	BUSINESS MEETING
2:00 p.m.	

SYMPOSIUM

Debate - "Who Owns The River?"

Moderator: Mr. James Harrison
 Executive Director
 Minnesota - Wisconsin Boundary Area Commission
 Hudson, Wisconsin

Participants:

Mr. Michael Ferring
 Legal Counsel
 U. S. Army Corps of Engineers
 St. Paul, Minnesota

Mr. George Meyer
 Assistant Administrator
 Division of Enforcement
 Wisc. Dept. of Natural Resources

Mr. Jonathan Ela
 Midwest Representative
 Sierra Club
 Madison, Wisconsin

Representative for
 Water Transportation Interests,
 unconfirmed at this printing

MISSISSIPPI RIVER RESEARCH CONSORTIUM

14th ANNUAL MEETING

DEBATE

WHO OWNS THE RIVER?

2 P.M. - April 3, 1981

Participants:

Mr. Michael Ferring
Legal Counsel
U.S. Army Corps of Engineers
St. Paul, Minnesota

Mr. George Meyer
Assistant Administrator
Division of Enforcement
Wisc. Dept. of Natural Resources

Mr. Jonathan Ela
Midwest Representative
Sierra Club
Madison, Wisconsin

Representative for
Water Transportation
Interests, still unconfirmed.

Moderator:

Mr. James Harrison
Executive Director
Minnesota - Wisconsin Boundary Area Commission
Hudson, Wisconsin

Debate Topic:

Legally and politically the water transportation interests control the fate of the Mississippi River.

Supporting Assumptions:

1. Existing water resources laws and political power give water resource development priority over natural resource values in virtually every case where there is a conflict.
2. The Corps of Engineers' Civil Works Division is legally mandated to do everything possible to enhance the efficiency and productivity of the water transportation system.
3. Environmental laws and regulations have consistently proved either ineffective or only temporarily effective in protecting natural resource values when there is a conflict with water transportation interests.

Specific Subjects to be included in Debate:

1. The Lock and Dam 26 Bill.
2. The failure of the Upper Mississippi River Basin Commission to get a critical extension of the Master Plan Study mandated in the L/D 26 Bill.
3. The Tennessee-Tombigbee Project.
4. The Tellico Dam.
5. The change in the COE's policy on barge fleeting regulation.
6. The conclusion of the Great River Environmental Action Team that the definition of a 9-foot channel should be one that allows for 9-foot draft vessels.
7. Congressional authority giving dredging needs absolute priority over the values of Upper Mississippi Refuge.
8. Congress still has not given the COE authority to spend money to specifically protect fish and wildlife in operation and maintenance of the 9-foot channel project.

**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 demonstrate an interest in any aspect of the Mississippi River, and who express a desire to join the organization.

ARTICLE IV. AMENDMENTS

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

**BY - LAWS
OF
THE MISSISSIPPI RIVER RESEARCH CONSORTIUM**

ARTICLE II. ORGANIZATION

Section I. Officers

- A. The officers of the organization shall consist of a President, a President-elect, and a Secretary-treasurer who shall perform such duties as are usually incumbent upon such officers.
- B. The officers of the organization shall be elected annually at the annual meeting and shall assume their duties immediately after the close of the last session of the meeting. At least two (2) months prior to the meeting, the executive committee shall appoint a nominating committee of at least three members. This committee shall make at least one nomination for each office and shall submit its report at the meeting. Additional nominations may be made from the floor of the meeting.
- C. The president shall not succeed himself.

Section II. Committees

- A. The executive committee shall consist of the officers and the most recent past president who maintains his membership.
- B. The program committee shall consist of the president-elect and two members appointed by the executive committee. The president-elect shall serve as chairman of the program committee.

- C. The executive committee shall appoint such other committees as may be deemed necessary from time to time.

Section III. Meetings

- A. There shall be one meeting held in each calendar year.
- B. The meeting shall be held in the home city of the president.
- C. The time of the meeting shall be established by the executive committee at the meeting one year prior, upon approval by two-thirds of the voting membership.
- 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 business.

ARTICLE III. MEMBERSHIP AND DUES

Section 1. Dues

- A. Dues shall be one dollar (\$1.00) per year.

ABSTRACTS

Electrical Output Calibration of the Coffelt Electroshocker Model VVP-15 by Oscilloscope

G. Lauer, D. McConville, and J. Haas
Environmental Studies Center, Biology Department
Saint Mary's College, Winona, MN 55987

The electrical output from the Coffelt Model VVP-15 electroshocker control unit was displayed and calibrated with an oscilloscope. All modes of operation were examined. Electrical output from the A.C., pulsed A.C. and D.C. modes were examined for wave shape and form over the operating voltage range of the unit. Pulsed D.C. was assessed for wave shape and form as influenced by voltage, frequency, and pulse width.

Output information was determined for all possible combinations of operations. Photographic records as well as numerical results were obtained. These output records were correlated with control panel settings for each simulated shocking run. A 250-volt line voltage transformer served as the laboratory power source and a series of variable light bulbs served as the load. Accuracy checks on the laboratory procedure was obtained by short-term operations of the VVP-15 control unit with input power provided with the normal field gasoline powered electrical generator.

Channel Dwelling Fishes of Pool 9, Upper Mississippi River

W. A. Hubert and D. N. Schmitt
Iowa Cooperative Fishery Research Unit, Ames, IA 50011

Channel dwelling fish communities in riverine reaches of Pool 9, Upper Mississippi River, were assessed during summer and autumn of 1980. Two sizes of hoop nets were used to sample navigated and unnavigated channel borders at three locations. Drifting trammel nets and stationary gill nets were used in navigated main channel areas. More than thirty species were collected. Sampling indicated channel communities to be dominated by catostomids and ictalurids. Little difference in catch-per-unit-effort or species diversity was noted between navigated and unnavigated channel borders. Substantial sampling gear selectivity was observed.

Impingement of Fish at Dairyland Power Cooperative's Genoa Site

M. McInerny
Biology Department, University of Wisconsin-La Crosse
La Crosse, WI 54601

The impact to the fishery of Navigation Pool 9 of the Mississippi River from impingement by two Dairyland Power Cooperative power stations near Genoa, Wisconsin, was determined. In addition survival rates and young-of-the-year juvenile:adult ratios were determined to further define the impact from impingement.

An estimated 8,390 (127.1 kg) and 54,349 (2915.7 kg) fish were impinged from 8 August 1978 through 30 June 1980, at La Crosse Boiling Water Reactor (LACBWR) and Genoa #3 (G-3) power stations, respectively. The two power stations collectively impinged representatives of 53 species and 19 families of fish. Bluegill (Lepomis macrochirus), freshwater drum (Aplodinotus grunniens), gizzard shad (Dorosoma cepedianum) and channel catfish (Ictalurus punctatus) were the most frequently impinged species. Young-of-the-year fish density, behavioral responses of some fish species and intake structure design were determined to be the most influential factors causing impingement at these plants. The impact to the Pool 9 fishery from impingement was judged insignificant. Recommendations for modification of some operation procedures were offered to the company to reduce the impact from impingement.

Species Composition of Hoopnetting Catches from Main Channel Border and Main Channel Habitats of Pool 26, Mississippi and Illinois Rivers

J. Broughton and K. S. Lubinski
Pool 26-River Research Lab, Illinois Natural History Survey
Grafton, IL 62037

A hoopnetting program at 4 sites on Pool 26 of the Mississippi and Illinois Rivers was conducted between June and October, 1980. The objective of the program was to compare species composition between several river reaches and two habitat types, main channel border (MCB) and main channel (MC) in order to 1) select representative reaches for future investigations into the effects of commercial traffic on fish movements and 2) generate information on habitat utilization. Two MCB sites (MR220 and MR223) were located on the Mississippi River, one on the Illinois River (IR3). The MC site (IR2.8) was located on the Illinois River. Two iron-ringed nets (each with 7 rings, 1.1-1.2m diameter and 2.5-3.8cm mesh) were set in series at each MCB site. A single wooden-ringed net (7 rings, 0.9-1.5m diameter, 1.0-2.5cm mesh) was used at the MC site. All nets were set parallel to the flow of the river with the open ends facing downstream.

In 244 net-days 9 species were collected at IR3. In 224 and 158 net-days at MR220 and MR223, 13 and 10 species were collected respectively. Freshwater drum and gizzard shad dominated the catch at all MCB sites. Nine species were taken in 15 net-days at IR2.8. Juvenile channel catfish were the most abundant fish in the main channel catch. Comparison of species composition at the different sites was accomplished using a percent similarity index (PSc), where 0.0=no similarity and 100.0=complete similarity. PSc's over the entire sampling period for the following MCB site combinations were: IR3 vs. MR220=74.0; IR3 vs. MR223=74.4; MR220 vs. MR223=60.6; IR3 vs. (MR220 and MR223)=89.5. Species composition between the MCB sites was considered comparable enough to recommend future studies of navigation impacts on fish movements in these reaches. Differences between habitats indicated that they will have to be studied separately in order to assess impacts on their different faunal assemblages.

The Aquatic and Floodplain Vascular Flora of the Mississippi and Illinois Rivers in Lower Pool 26

M. C. Reese
Pool 26-River Research Lab, Illinois Natural History Survey
Grafton, IL 62037

To develop a foundation for future studies, the Illinois and Mississippi Rivers and backwater areas of Pool 26 were examined for aquatic macrophytes while areas adjacent to these waters were examined for floodplain vegetation. Special emphasis for floodplain vegetation was placed on island flora. A total of 239 taxa of vascular plants comprising 73 families were collected during the study. Sixteen species of aquatic macrophytes were collected. Sagittaria latifolia Willd. and Nelumbo lutea (Willd.) Pers. were the most commonly encountered emergent species. The most widespread submergent species in the rivers was Potamogeton pectinatus L. while Ceratophyllum demersum L. was the most prevalent submergent species in backwater areas. Eagle Lake had the greatest number of aquatic macrophytes with 14 species. Of the 223 taxa of floodplain vascular plants only 149 or 67% were collected on islands. Although the dominant vegetation of island flora in lower Pool 26 was comparable to that of the floodplains bordering the rivers, island flora did not appear to be a clear indicator of the floristic diversity that exists on the floodplains as a whole. Chelone obliqua var. speciosa a rare and endangered plant in Missouri was collected on Mason Island in Missouri and Boltonia asteroides (L.) L'Her var. decurrens (Torr. and Gray) Engelm which is listed as threatened in both Illinois and Missouri was collected along the Illinois River.

Diel Drift and Abundance of Benthic Macroinvertebrates, Mississippi and Illinois Rivers, Pool 26

J. C. Hutton, H. H. Seagle, Jr., R. V. Anderson, and D. Leibig
Illinois Natural History Survey, Grafton, IL 62037
and
Western Illinois University, Dept. of Biology, Macomb, IL 61455

In order to accumulate baseline data for studies on the effect of navigation on macro-invertebrate drift in the Upper Mississippi River Basin, benthic and drift samples were taken during the summer of 1980. Illinois River Ponar samples produced primarily Chironomidae and Oligochaeta; Mississippi Ponars were dominated by Chironomidae and Ephemeroptera with Ceratopogonidae, Oligochaeta, and Trichoptera each comprising slightly over 5% of the total specimens. Ponar samples indicated that silt substrates in the Illinois River generally exhibited greater standing crop and diversity than sand substrates in the Mississippi River. Mississippi River artificial substrates (rock baskets and multiplates) were dominated by *Potamyia flava*, *Hydropsyche orris*, and Chironomidae. Illinois artificial substrates were dominated by *Cynellus fraternus*, Chironomidae, and Oligochaeta. Artificial substrates in the Mississippi River were colonized by twice as many taxa and 23 times more organisms than similar samplers in the Illinois River. Siltation appeared to be an important factor in limiting colonization in the Illinois River. Diel drift samples (4 replicates, 15 minute sample, 4 times over 24 hours) in the Mississippi were dominated by Hydropsychidae, Ephemeroptera, and Diptera while Illinois River samples were dominated by Chaoborus. Analysis of the drift data indicated that 15-30 minute samples were sufficient to collect 60-90% of the drifting taxa; composition of the drift community appeared to be depth dependent; greatest numbers of taxa were collected at depths of 0.3m and 3.5m; greatest drift densities generally occurred at 2200 and 0100. Differences in the benthic and drift community in the Mississippi and Illinois Rivers are probably the result of physical and chemical differences in the two rivers.

Studies to Assess the Physical Impacts of Navigation

J. R. Adams and M. Demissie
Illinois State Water Survey, P. O. Box 5050, Station A
Champaign, IL 61820

A comprehensive review of literature on the effects of recreation and commercial vessel traffic on inland waterways identified information gaps. Studies to fill these information gaps are outlined and prioritized. Six studies with an estimated total cost of \$1,242,000 are proposed to investigate the effects of project construction, operation, and maintenance. Seven studies with an estimated total cost of \$1,685,000 are proposed to investigate the effects of vessel traffic. Study time periods are between 2 and 5 years. The studies were assigned to three priority classes: I, Urgent; II, Necessary; or III, Beneficial. Six are in class I, two in class II, and five in class III.

Waves Generated by River Traffic

M. Demissie, J. R. Adams, R. Allgire and S. Osakada
Illinois State Water Survey, P. O. Box 5050, Station A
Champaign, IL 61820

An excessive amount of soil erosion along a number of waterways in Illinois and the surrounding states exists at the present time. Along some reaches of the Illinois River, 75 percent of the banks are being eroded away by waves generated by river traffic and wind. Similar types of bank erosion problems exist along the Mississippi and Ohio Rivers. Erosion of stream banks attracts public attention, reduces property value, results in permanent loss of real estate, increases turbidity of the stream, and accelerates the silting of reservoirs or backwater lakes along the stream course.

In order to prevent the erosion of stream banks by waves, an understanding of the characteristics and energy content of the waves generated by river traffic and wind is necessary. Field data on waves generated by river traffic were collected by the Illinois State Water Survey staff during the passage of barges and pleasure boats along the Illinois River. Some of the data collected have been analyzed and maximum wave heights determined. The maximum wave heights observed during two field trips ranged from 0.15 feet to 0.8 feet.

The presentation will include the data collection procedure, the wave data and the results of the data analysis.

Field Methods for Measuring the Lateral Movement of Suspended Sediments in Rivers Associated with the Movement of Commercial Vessels

A. P. Bonini, D. J. Kisser, and D. K. Davie
Illinois State Water Survey, P. O. Box 5050, Station A
Champaign, IL 61820

Very little information is available regarding techniques for collecting data related to the lateral movement of sediment in rivers. Techniques are available for collecting sediment concentrations in order to determine suspended sediment discharge in a stream cross section. Some of these techniques were found to be adaptable to measuring the lateral movement of sediments and were combined with the use of standard surveying equipment to develop a methodology for collecting all the data necessary for analyzing the impact of commercial vessels on the lateral movement of sediment in rivers.

This paper will discuss the objectives of the data collection program as well as the methods that were developed to fulfill these objectives. The design process and the field application will also be presented.

Lateral Movement of Sediment Due to River Traffic

N. G. Bhowmik, M. Sexton, and J. Guo
Illinois State Water Survey, P. O. Box 5050, Station A
Champaign, IL 61820

Sediment particles in a river normally move in the downstream direction with the flow. The movement of river traffic sometimes changes this mode of sediment transport. Large tows with barges may resuspend or redistribute the sediment particles in a river and transport these particles in a lateral direction. Research conducted at the Illinois State Water Survey has shown that the concentration of sediments in the river in the lateral direction increases during and after the passage of tows with barges. These sediments may eventually be transported into the backwater areas along the main river. Some of the data collected so far and the analyses that were performed will be discussed and presented in this paper. In some instances the concentration of suspended sediments was increased two- to three-fold after the passage of tows with barges. A series of tows with barges passing within a short period of time may elevate the ambient sediment concentration in the river.

Water and Sediment Inputs to Selected Side Channels Associated with River Traffic

M. T. Lee, W. C. Bogner, and W. P. Fitzpatrick
Illinois State Water Survey, Champaign, IL 61820

Side channels and backwater lakes along the Illinois River are losing their capacities to sedimentation. Obviously, the sediment is flowing into the side channels and lakes from the river. Recently, it has been alleged that one of the effects of river traffic is the movement of the suspended sediment laterally into the shallow part of the river and eventually into the side channels and backwater lakes adjacent to the river. This study is designed to investigate the actual movement of the sediment and water into the backwater lakes and side channels of the Illinois River.

Field data collection consisted of establishing sampling cross sections at the upstream and downstream ends of the side channel. These cross sections were monitored for suspended sediment concentration and water discharge on a continuous basis. Suspended sediment samples were taken using the DH-59 depth integrating suspended sediment sampler. Water velocity was measured with a Price type current meter. During periods of barge passage, water velocity data were collected continuously at 30-second intervals for a period of 5 minutes prior to the barge passage at the mouth of the channel and for a period of 10 minutes or more after the barges had passed. The suspended sediment samples were taken at the same time the velocity readings were taken. In addition, continuous stage recorders were used to measure the water level fluctuations. Two field trips were completed in 1980. Thirteen barge events were measured. Preliminary results indicated that the flow velocity drops immediately prior to the barge passage, then fluctuates before returning to a steady background level. At one event, the suspended sediment concentration showed about two-fold increase approximately 15 to 20 minutes after the passage of the barge.

Analysis of Hydrological, Hydraulic, Sedimentation, Morphological and Thermal Changes in the Kizhuyak and Terror Rivers Associated with Terror Lake Hydroelectric Project

D. B. Simons, R. M. Li, and Y. H. Chen
Simons, Li & Associates, Inc., P. O. Box 1816, Fort Collins, CO 80522

Development of the Terror Lake Hydroelectric Project, Kodiak Island, Alaska, is being planned by Kodiak Electric Association, Inc. It is proposed to provide storage by raising the level of Terror Lake. With the storage reservoir, water from Terror Lake will pass through a five-mile long power tunnel to the adjacent valley of the Kizhuyak River, where it will pass through a penstock to a power house in the valley and then join the natural flow of the Kizhuyak River. The flows diverted from Terror Lake will increase the long-term annual average flows in the Kizhuyak River, causing the river to establish a new regime over a period of years and will probably affect the fish spawning capacity of the river. Also, the diversion of flow will cause changes in the natural temperature conditions in the Terror River and the Kizhuyak River. The reduction of flows in the Terror River will cause changes in its hydraulic characteristics and possibly in the stream's morphology that may alter the fish spawning capacity of the rivers. In order to evaluate the above-mentioned effects, our analysis of hydrological, hydraulic, morphological and thermal changes was conducted. The geomorphic changes of the river systems were estimated by applying a water and sediment routing method developed by Simons and Li. Then the hydraulic parameters related to fisheries such as top width, velocity, flow depth and substrate were determined by applying a calibrated HEC-2 model. A reservoir and stream thermal simulation model package was utilized to evaluate effects of the project on thermal regimes.

A Geomorphic and Mathematical Model Study of Pools 4 through 8 in the Upper Mississippi River System

D. B. Simons and Y. H. Chen
Department of Civil Engineering, Colorado State University
Fort Collins, CO 80523

All the man-induced activities, construction of dikes and locks and dams, operation of locks and dams, and dredging have changed the river characteristics. In this study, the past and present geomorphic features of the Upper Mississippi System between Locks and Dams 4 and 8 were investigated and the principal causes of these changes were identified. Then a one-dimensional water and sediment routing model was developed for the Upper Mississippi River to assess the effects of different management alternatives on the dredging requirement of the river system. The studied alternatives include: normal dredging, overdredging in some areas, construction of dikes, reduction of sediment inflow from the Chippewa River and closure of outlets from the main channel to backwater areas. The model can help determine the appropriate locations of dikes, the optimum depth of dredging and in general, the effects of any change in the river system.

Because a large amount of data is involved in the study, a data base management system was developed to manage hydrologic, hydraulic, geomorphic and control structure data. This data system can effectively retrieve and process the data to analyze the evolution of the Upper Mississippi River basin, expedite the daily duties of the technicians, provide a system that can be used by persons not proficient with the computer and develop a system with a flexible structure to enable improvements or expansions with major modifications to be made.

Side Channel Discharge as a Function of Slope in Navigation Pool No. 9

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The rates and routes of water passage through the upper 17 km reach of Navigation Pool No. 9 were investigated during the summer of 1980. Turbidity was also measured at 24 main channel, side channel, and backwater areas on 28 dates during the study period. Cross-sectional areas of the main channel and of 20 selected side channels were determined and total discharge was calculated for these sites at four flow regimes, ranging from 12,250 cfs to 78,000 cfs (total river discharge, L & D No. 8). Simultaneous water level readings were made at Lock and Dam No. 8 and the control point (Lansing, Ia.); slope was then calculated and a simple linear regression was performed to describe the relationship between total discharge and slope. The flow through side channels was a function of the channels distance from the control point.

Discharge through all observed side channels increased with slope, however, the percent total flow increased with distance from the control point and this relationship provides a basis for side channel flow predictions as a function of total river discharge.

Flow Rates to Backwaters of the Mississippi River

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The transport of water between the main channel and 66 side channels for the upper 20-mile reach of Pool 9 is being evaluated. An empirical computer model based upon these data is being developed. This can be used to determine the proportion of total river flow entering backwaters as flow rates and pool levels fluctuate.

Investigation of the Effects of Chippewa River Erosion and Silt Reduction Measures

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Erosion and sedimentation have long been recognized as severe problems along the Chippewa River, especially in the lower reaches below Eau Claire. River banks composed of sand and fine gravel are being eroded and transported by the Chippewa flow, resulting in some loss of floodplain. Much of the sediment is ultimately transported to the Mississippi River, its side channels and backwater areas. It is necessary to periodically dredge the deposits of excess sediment to provide adequate water depth for navigation in the Mississippi River. This dredging and disposal of dredged material has been a principal obstacle in developing recommendations to minimize resultant aquatic habitat damage.

A number of alternative erosion and silt reduction measures were identified and evaluated to determine the most feasible alternative and to assess the impacts of these measures on the physical, biological, socioeconomic, and cultural environments. These impacts were measured primarily in terms of national economic development (NED) and environmental quality (EQ). The study area was described in terms of its physical, biological, socioeconomic and cultural components. Based on this baseline information, predictions were made on the with- and without project conditions. The study then focused on the alternatives themselves to select that which most nearly met the NED and EQ criteria. Results indicated that streambank protection plus a 10-ft low-head dam with dredging behind was the most feasible.

Reproduction and Feeding Habits of the Great Blue Heron *Ardea herodias* at Mississippi River Mile 609.25

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Weekly observations were made at the southern rookery of Brinkman Island from 11 May until 30 July 1980. Egg shells observed on the ground indicated that 95% of the eggs hatched, with 75% of the hatching occurring before 11 May. Twenty-five selected nests produced an average of 2.52 young per mating pair. These 63 young incurred a mortality rate of 27% before fledging during the last three weeks of July, with death typically due to fallen nests.

Only 19% of birds leaving the rookery flew inland, indicating that feeding characteristically occurs in waters of the Mississippi, with 82% of the river feeding in backwater areas. Collections of fish dropped from nests yielded a ratio of 68% game to 32% non-game fish, with an average fish length of 10.6 inches. Fish were found in 81% of the stomachs of 16 dead nestling herons and crayfish were found in 56%.

A Report of the Ciconiiformes and Charadriiformes Visiting the Commer's Chute Sandbars of Northwestern Lake Onalaska

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Thirty-two visits by the author over the thirteen years 1968-1980 discovered 39 species of the 54 possible species of herons, plovers, sandpipers, phalaropes, jaegers, gulls, and terns listed for Wisconsin. Seventy percent of the listed Ciconiiformes were seen and 73% of the Charadriiformes. Of the 39 species seen of the 54 listed, 4 are rare. Of the 15 species not seen, 11 are rare.

Data describing changes in elevation and size of these sandbars are not available. Elevations above water level are less than one foot. Factors affecting elevation are river stage and wind direction. Birds of the orders discussed make heavy use of the sandbars for resting and feeding. At least one species has nested on the sandbars. Over the period visits were made by the author, this unique avian habitat attracted a high percentage of species of these non-game orders of birds.

Quantitative Analysis of Naiad Mollusks from the Prairie du Chien, Wisconsin, Dredge Material Site on the Mississippi River

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The Prairie du Chien dredge material site contains about 100,000 cubic meters of material dredged from the East Channel of the Mississippi River in 1976. Previous studies in that area suggested a rich molluscan fauna, but most studies were only qualitative or simply general observations. Our study of this material was designed to determine the density and diversity of molluscan fauna, to assess changes in the fauna, to identify indigenous species previously unreported, and to evaluate the status of the endangered species *Lampsilis higginsii*. In 10 m³ of dredge material sieved to recover shells, we found 38 species of naiades and up to 1,737 identifiable naiad valves per cubic meter. The endangered *L. higginsii* ranked 18th in frequency of occurrence, accounted for 0.52% of the identifiable shells, and averaged about three valves per cubic meter. From a total of 813 kg of naiades and gastropods, 6,339 naiad valves were identified. Five naiad species were collected at the site for the first time; one of these *Epioblasma triquetra*, had not been previously reported in the Prairie du Chien area. Although the molluscan fauna has changed in species composition, the East Channel at Prairie du Chien is obviously suitable for *L. higginsii*.

Investigations of Declines in Fingernail Clam (Musculium transversum) Populations in the Illinois River and Pool 19 of the Mississippi River

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The disappearance of the fingernail clam, Musculium transversum, from a 100 mile section of the Illinois River during the 1950's and recent declines of populations of this clam in Pool 19, Mississippi River, have led to research which attempts to isolate the factor(s) responsible for these declines.

A rapid screening technique measures the beating rate of cilia on excised clam gills while the gills are exposed to Illinois River water and sediment. Factors which have detrimental effects on the gill preparations are subsequently tested on intact clams in chronic bioassays.

Raw Illinois River water and layers of sediment from the interface to 4 inches deep from a bottomland lake along the river inhibit the beating of cilia on the gills. Intact juvenile clams exposed to untreated Illinois River water exhibited significant mortality rates (69 percent) after 6 weeks compared to clams maintained in clean well water (23 percent). The mortality rate, after 6 weeks, of clams exposed to river water filtered through sand, charcoal, or clinoptilolite was 8, 7.5, and 10 percent respectively.

A First Hand Look at the Bottom of the Mississippi River

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During the summer of 1980 naiad molluscs were collected from over 250 sites on the bottom of the Mississippi River by SCUBA diving for the Wisconsin Department of Natural Resources-Mississippi River Work Unit, La Crosse. SCUBA diving allowed some unique and interesting first-hand observations of the river throughout Pool 10. Although collections were restricted to the contents of a 25-ft² frame, observations were also made outside the frame. General observations were made on silt, sand, clay, gravel, and rock substrate types, and on the positions of molluscs in the substrate. Five sites were sampled on each transect across the river (two backwater, two main channel border sites, and one main channel). Transects were located at approximately one mile intervals. In addition, 65 random sites were sampled in the East and West Channels at Prairie du Chien, WI.

Other observations included increased turbidity and the reversal of river flow from the direction of barge passage (upstream or downstream). Disturbance to naiad beds and damage to shells were observed in the main channel and in areas of barge fleeting.

Some privately sponsored, free-diving was done in the fall of 1980 in Pools 7, 9, and 10. Free diving provided a larger sample area as opposed to a sample frame. Free-diving on wing dams and riprap proved fascinating as well as providing valuable information on naiad habitat. With experience, it became possible to identify many naiad species by touch while underwater.

A Survey of the Mussel Densities in Pool 10 of the Upper Mississippi River

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Freshwater mussels were collected during the summer of 1980 from the main channel, main channel borders and backwater areas of Pool 10 of the Upper Mississippi River. Of the 309 sites sampled by SCUBA diving, mussels were found at 224 sites. The area downstream from the confluence of the Mississippi River and Wisconsin River had the highest percentage of nonproductive sites (37%) and the lowest mussel density (0.71 per ft²). The East Channel near Prairie du Chien, WI had the richest mussel fauna with an average density of 2.96 mussels per ft² and only 6% of the sites were nonproductive.

A total of 31 live species of unionid mussels were collected in Pool 10; an additional 6 species were represented only by dead specimens. Threeridge (Amblema plicata) was the most abundant species with an overall average density of 0.83 per ft². Thirty-eight live specimens of Higgins' Eye (Lampsilis higginsii), a state and federal endangered species, were found. The East Channel showed the highest density of Higgins' Eye (0.02 per ft²).

Investigations of Dredged Material Disposal Sites in Pools 12, 13, and 14

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Physical monitoring was conducted at three locations: a Dubuque productive use contained disposal site, an inactive LeClaire river island disposal site, and inactive Green Island levee disposal sites. Plant survey, soil, surface and ground water data were obtained. The purpose of the monitoring was the examination of variables which could be applied to a comprehensive environmental monitoring program for dredged material disposal in the upper Mississippi River region. It is known that levee and river island disposal types reduce vegetative productivity and greatly alter general conditions. Long-term effects, however, are not clear. Thus, age characterization of disposal sites should be established through further study. Some of the plant species were found to be quite common, having potential as indicators for long-term changes. This work further documented the range for some species on disposal sites, such as *Sporobolus cryptandrus*, *Cyperus Schweinitzii*, and *Triplasis purpurea*. The monitoring of an active productive use site indicated that study of a potential disposal site can be more important than study of the dredge disposal operation. Substances within the disposal site caused more adverse environmental impacts than the dredged material source or hydraulic slurry. Thus, standardized biological, physical and chemical monitoring methods should also be applied to a pre-operation monitoring program. New methodology for the river system is required, since the changing configurations of both land and aquatic disposal sites have presented difficulty in the assessment of quantitative data.

Chemical Characteristics of Dredge Material from Ten Sites on the Upper Mississippi River

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Dredge material was collected from 10 sites on the Upper Mississippi River between St. Paul and Winona, Minnesota. The sediments were analyzed to determine the concentration of contaminants associated with the sediments and were evaluated for the potential of contaminant release during dredging operations. Chemical characteristics were determined by standard analytical procedures for three types of sample preparations: (1) sediment per se, (2) suspended particulate materials, and (3) a filtered elutriate. Analyses were run to determine volatile solids, pH, COD, BOD, total phosphate, orthophosphate, ammonia nitrogen, nitrite and nitrate nitrogen, oil and grease, chromium, copper, lead, zinc, nickel, mercury, cadmium, PCB's, DDD, DDE, DDT, endrin, dieldrin, and chlordane. Concentrations of the various chemicals were generally highest for total sediment samples; values for solutions of suspended particulates were generally higher than those for millipore filtered elutriates. Most contaminants were not extractable in water, as indicated by the low contaminant concentrations found in elutriate samples. It is likely that few of the observed concentrations of contaminants, by themselves, would be acutely toxic to aquatic organisms. The possible exceptions were ammonia nitrogen, cadmium, and zinc in the more heavily contaminated samples. The only sediment samples that were classified as heavily polluted, based on analyses for the various contaminants, were those from the Red Wing Commercial Harbor and the St. Paul Barge Terminal. These two samples consisted of large proportions of silt and clay and reflected a strong inverse correlation noted between particle size and concentration of the contaminants among the 10 sample sites. Funds for the study were provided by the U. S. Army Corps of Engineers, St. Paul District.

Biological Activity of Dredge Material from Ten Sites on the Upper Mississippi River

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This study was conducted to determine the biological activity of dredge material from 10 sites on the Upper Mississippi River between St. Paul and Winona, Minnesota. Toxic effects were assessed in static bioassays by exposing aquatic organisms to (1) sediments under stable water conditions, and (2) suspended particulate materials that were maintained in solution or suspension by aeration. Organisms tested were scuds (Gammarus pseudolimnaeus), crayfish (Procambarus sp.), mayfly nymphs (Hexagenia sp.), midge larvae (Chironomus tentans), snails (Physa gyrina), fawnfoot mussels (Truncilla donaciformis), fingernail clams (Sphaerium sp.), fathead minnows (Pimephales promelas), and channel catfish (Ictalurus punctatus). Sediment samples from the 10 sites were characterized as being of two types: (1) predominantly sand, and (2) fine sand with substantial amounts of silt, clay, and colloidal materials. Toxic activity observed in particulate phase exposures was related to the type of sediment material. Samples that contained predominantly sand were essentially nontoxic; samples that contained substantial amounts of silt, clay, and colloidal material often produced a toxic effect (mortality). As a rule, particulate phase exposures were more toxic than solid phase exposures. Samples from the Red Wing Commercial Harbor and St. Paul Barge Terminal were the most toxic sediments tested. Samples from the eight other sites were essentially nontoxic in both types of exposures.

An Investigation of Lake Pepin Bottom Sediments/Characteristics (Particle Size, Organic Content, Heavy Metals, TKN, TP)

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A study was undertaken in the summer of 1979 to characterize the sediments in Lake Pepin in terms of particle size distribution, and concentrations of organic material, total Kjeldahl nitrogen, total phosphorus and six heavy metals (Cd, Cu, Zn, Ni, Pb, Cr). The samples were obtained by compositing surface sediments collected from transects across the lake.

Results indicate that the surface sediments in much of the lake were silts and clays, and the percentages of organic content ranged from 1 to 11%. The greatest concentration of total Kjeldahl nitrogen and total phosphorus were found in the sediments with highest organic content. Levels of these variables were highest in the samples taken in the middle and lower reaches of the lake. The concentration of all metals analyzed were at least ten times higher in the samples from the middle segments of the lake as compared to the extreme upper and lower ends.

A large number of discrete grab samples were obtained in the summer of 1980 to further delineate the spatial distribution of heavy metals.

Longitudinal Distribution of Trace Elements in Two Species of Fish in the Upper Mississippi River

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Sampling was conducted during September, October, and November of 1979 for a survey of selected trace elements (As, Cd, Cr, Pb, Hg, and Se) in biotic and abiotic components of the Upper Mississippi River (UMR). Carp (*Cyprinus carpio*) were collected at fifteen locations on the UMR from Sartell, Minnesota, to navigation pool 11 near Guttenberg, Iowa. Bluegill (*Lepomis macrochirus*) were obtained at eleven locations on the UMR, including a site near Monticello, Minnesota, and navigation pools 4-11. Trace element concentrations were measured in whole bluegill, carp liver, and whole carp less liver and gastrointestinal tract contents. Trace element concentrations in whole carp and carp liver were generally highest in samples from sites near Fridley and Monticello and pools 2, 3, and 4. Concentrations of trace elements in whole bluegill were generally highest in samples from pools 7 and 4 and the site near Monticello. Significant, positive correlations occurred for concentrations of Cd, Cr, Pb, and Hg between whole carp and carp liver. With one exception, trace element concentrations in bluegill and carp from different locations were not correlated. The maximum observed concentrations of As, Cd, Pb, Hg, and Se occurred in carp liver, whereas Cr concentrations were greatest in whole bluegill. Concentrations of Cd and Pb in UMR bluegill were similar to values reported for bluegill from relatively uncontaminated systems and were substantially less than values reported for whole bluegill from Cd and Pb-contaminated surface waters. In contrast, Cr concentrations in UMR bluegill appear to be relatively high. Information on trace element concentrations in carp from uncontaminated and contaminated waters elsewhere are being obtained and will be compared to concentrations in UMR carp. Factors affecting availability of these trace elements to fishes in the UMR will be discussed.

A Hydrologic Simulation for Predicting Nonpoint Source Pollution

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A hydrologic model for use in predicting nonpoint source pollution is developed herein. The model is a mathematical representation of watershed hydrology and hydraulics. It is formulated to investigate watershed response in management activity. The simulation may be used to predict watershed response to forestry activities including both planned management practices, such as timber production and harvest, road construction, watershed management, stream improvement, pesticide application and runoff, fertilization, foliage production and grazing, mechanical site preparation, centralized burning, and unplanned activities associated with catastrophic events, such as wildfire and other damage from severe natural events. Non-point source pollution from these activities and events may include loading of streams by: 1) sediment from surface erosion, mass wasting, channel bottom and bank erosion, 2) thermal energy, 3) biological contaminants, 4) organic debris, 5) nutrients and dissolved solids, and 6) pesticides. The simulation presented allows the estimation of these environmental impacts.

Continuous Automatic Monitoring of the Upper Mississippi River in the Twin Cities Area

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The MWCC, as part of its comprehensive monitoring network, maintains 12 automatic monitors located at strategic points along the Upper Mississippi, Lower Minnesota, St. Croix, and Vermillion Rivers in the 7-county Twin Cities Metropolitan Area.

The 12 units continuously monitor dissolved oxygen, temperature, pH, and specific conductance. Data are recorded on paper punch tapes as well as being transmitted via a telemetering system to a computer station where signals are collated and issued at 15-minute intervals.

Because of the large number of data generated, only daily means, minima, and maxima have been available routinely. However, recently proposed revisions of water quality standards, specifically dissolved oxygen, for surface waters in Minnesota have necessitated a more thorough evaluation of the diurnal fluctuations in dissolved oxygen. Such fluctuations, primarily caused by algal activity, are not apparent from subsurface grab samples normally collected for monitoring purposes but that are, nevertheless, potentially very significant in impacting indigenous aquatic life. Spectral analysis has been employed as one means of assessing these diurnal and other periodic phenomena.

Start-up of a Bioassay Trailer for Monitoring Waste-Water Effluent Impacts on the Mississippi and Minnesota Rivers

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The MWCC (Mpls.-St. Paul, MN) is in the process of developing and implementing a mobile bioassay/toxicity-testing program for monitoring wastewater treatment plant effluent impacts on the Mississippi and Minnesota Rivers. The toxicity-testing program is being developed in anticipation of compliance monitoring to be enforced by federal or state agencies in the foreseeable future.

A 24-ft. trailer will house two continuous-flow diluter systems each delivering 8 effluent concentrations (0%-100%, in a 56% series) in duplicate to 16 aquaria. In addition, instrumentation will continuously monitor D.O., pH, temperature, and conductivity of both the dilution water and effluent.

Initially, bioassays will be 96-hr. acute tests using juvenile fathead minnows (Pimephales promelas) or bluegills (Lepomis macrochirus), although the system will be adaptable, so that other test organisms (macroinvertebrates, zooplankton) may be utilized in the future. Test results will be expressed as a 96-hr. LC50 or EC50.

Since the bioassay facility will be portable, all treatment plants under the MWCC's jurisdiction can be monitored on a regular basis. Although the trailer is still in the developmental stage, preliminary testing is scheduled for late summer, 1981.

An Investigation of Main Channel Border Habitat of Pool 5A, Upper Mississippi River

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Sampling was conducted from June to September 1980. A hydrographic survey and map of pool 5A main channel border (MCB) habitat was completed. Surficial substrate of the MCB in pool 5A was surveyed and mapped according to three categories: predominately rock, predominately sand, and predominately silts and clays. Current direction and velocity in the MCB during summer low-flow conditions were measured and mapped. A classification scheme of Pool 5A MCB physical habitat types was developed, and 18 sites within the Pool 5A MCB were selected for study, each representing a specific habitat type. Fish were collected using an AC-DC electrofishing unit, frame nets, seine and an otter trawl. Benthic macroinvertebrates were collected with drift nets, Ponar dredge, artificial substrates (wire baskets filled with local rocks and wood), hand collections and directly from river rocks. In addition, a reconnaissance survey to observe the species composition and relative abundance of macroinvertebrates on every rock structure in the Pool 5A MCB was conducted. Aquatic macrophytes of the Pool 5A MCB were also surveyed. Analysis of the data, currently under way, will yield information that would increase our knowledge of Upper Mississippi River MCB areas.

Land Cover and Land Use Changes on the Upper Mississippi River Floodplain due to the 9-Foot Channel

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This project, sponsored by the Environmental Branch of the U. S. Army Corps of Engineers, St. Paul District, was designed to determine the type and extent of natural and man-influenced changes due to construction, operation, and maintenance of the nine-foot navigation channel. The study area was the floodplain and water area of the Upper Mississippi River between Minneapolis, Minnesota and Guttenberg, Iowa.

Three discrete time periods were assessed utilizing aerial photography as the primary data source. These periods were: circa 1929, the period immediately before construction of the locks and dams of the nine-foot navigation channel; circa 1939, the year all locks and dams were completed and navigation pools filled; and 1973, a time interval which may have allowed a new equilibrium to be reached following construction. Type maps were constructed for each time period on 1:6,000 ratioed and rectified 1973 photomaps. Acreage values were obtained by covertype and year on a photomap and navigation pool basis.

The results of comparisons of land cover and land use for these time periods and possible causes for changes are summarized.

Master Plan for Recreation and Resource Management, Upper Mississippi River

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"Will implementation of GREAT recommendations on channel maintenance dredging cause river recreationists to place greater pressure on more environmentally-sensitive river areas? How will implementation of Great River Road funds impact on overall river use? Should Corps-owned lands provide for future recreation use as well as serving fish and wildlife refuge purposes?"

These are several of the many important questions that the St. Paul District, Corps of Engineers, will address in an update to that existing recreation resources master plan for the Upper Mississippi River. The new plan will focus on how Corps management of river resource activities, facilities, and land resources impact on provision of recreation opportunities. With the cooperation and assistance of the U. S. Fish and Wildlife Service and other Federal, State, and local agencies, the Corps will attempt to identify the balance needed between competing and complementary resource uses as they relate to the provision of recreation opportunities and to fish and wildlife protection and enhancement.

A key constraint upon good resource planning on the river is the lack of sound user data. Also lacking is documentation of the impacts that this use has on environmental resources. The plan will also address the need for ongoing long-term resource monitoring related to recreation use and the importance of management coordination between Federal, State, and local agencies to support such a program.

Regional List of Vascular Plants of Biological Concern in the Five States of the Upper Mississippi River

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Inventory and management of critical plant species (listed, proposed, or noted as of biological concern) in the five states of the Upper Mississippi River valley (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) is complicated by the lack of a regional list. Available lists represent different stages in the overall listing process. The working (or final list) documents are highly idiosyncratic in that they differ in format, nomenclature, arrangement, and the meaning and coding of plant status. Of the total regional list (1,222 species), 80% are noted for just one of the five states. Only 8 species are noted for four or five states. Fourteen families account for 60% of the listed genera and 59% of all species. In contrast, of the approximately 900 species known from the Upper Mississippi River floodplain, only 75 occur on the regional list. Two-thirds of these species are noted in two or one state list. Clerical problems encountered in compiling the regional list might be resolved during the man-dated review of lists by each state.