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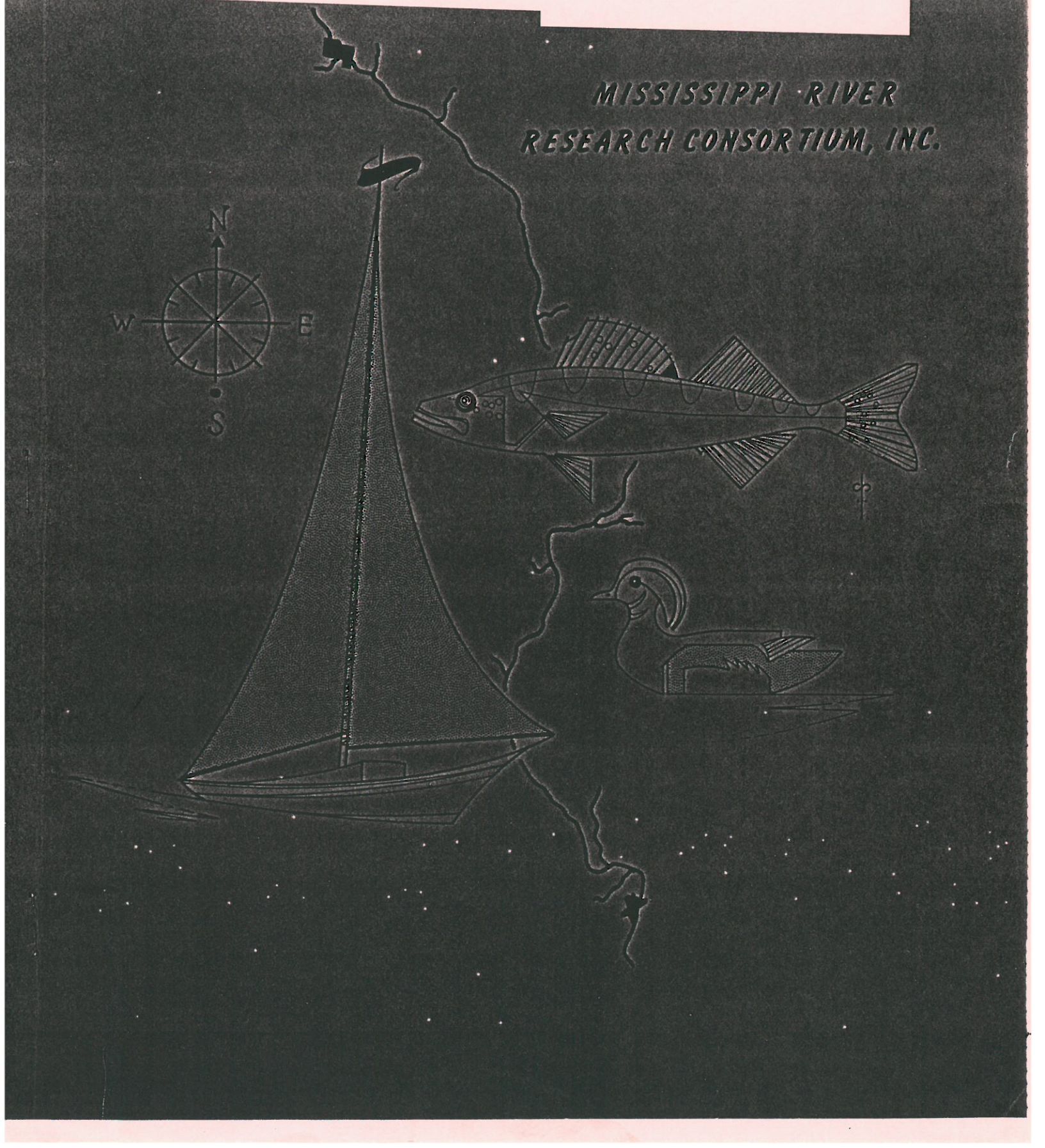
MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.



18th ANNUAL MEETING

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

1-2 May 1986

La Crosse Radisson Hotel

La Crosse, Wisconsin

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18th Annual Meeting of the Mississippi River Research Consortium, Inc.

1985-86 Board of Directors

Dr. James W. Eckblad, Luther College, Decorah, IA

Dr. Carl E. Korschgen, Northern Prairie Wildlife Research Center, La Crosse, WI

Dr. James H. Peck, University of Arkansas-Little Rock

Exhibits Committee

Mr. William L. Green, Northern Prairie Wildlife Research Center

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

Liaison with the La Crosse Radisson Hotel and Stoddard Restaurant

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

Preregistration

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

PROGRAM SCHEDULE

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

18th Annual Meeting

La Crosse Radisson Hotel

Thursday, 1 May, 1986

SESSION 1	Moderator: J. Eckblad
8:30 - 8:40	Welcoming Remarks. J. Eckblad
8:40 - 9:40	Overview of Mississippi Research. J. Rasmussen and A. Miller
9:40 - 10:00	Community and population characteristics of mussels in the bed at Illinois River Mile 3.0-L. K. S. Lubinski
10:00 - 10:20	Nongame monitoring needs on the Upper Mississippi River. M. J. Mossman
10:20 - 10:40	Coffee Break
SESSION 2	Moderator: D. Kennedy
10:40 - 11:00	Geomorphological aspects of long-term ecological research in the Upper Mississippi River Basin. M. E. Holden, D. I. Casavant, D. L. Gross, M. D. Grubb, S. M. Orbock Miller, and M. V. Miller
11:00 - 11:20	Sedimentation patterns in Quincy Bay. J. R. Adams, W. C. Bogner, and F. S. Dillon
11:20 - 11:40	Fish passage through dams on the Upper Mississippi River. D. B. Wilcox
11:40 - 12:00	The stabilization of dredge spoil with American beachgrass. T. O. Claflin and J. H. Peck
12:00 - 1:20	Lunch
SESSION 3	Moderator: T. Coon
1:20 - 1:40	Early life history of channel catfish in Navigation Pool 7 of the Upper Mississippi River. M. C. Duval and L. E. Holland
1:40 - 2:00	Evaluation of long-term changes in aquatic macrophyte development using high altitude aerial photography--methods and results. D. M. Day, R. V. Anderson, J. W. Grubaugh, and R. E. Sparks
2:00 - 2:20	The use of electophoretic techniques to evaluate population relationships in mussels of Pool 19. M. A. Romano, R. V. Anderson, and P. Hessler
2:20 - 2:40	The importance of borrow pits to fish populations in the Upper Mississippi River Valley. H. R. Dames and G. B. Farabee
2:40 - 3:00	The herpetofauna of the Weaver Dunes. P. A. Cochran
3:00 - 3:20	Break

SESSION 4	Moderator: L. Holland
3:20 - 3:40	A quantitative mussel survey at Prairie Du Chien, Wisconsin: Year 2. A. C. Miller and B. S. Payne
3:40 - 4:00	The effects of macrophyte beds on macroinvertebrate communities and island development. R. V. Anderson, J. D. Ives, R. E. Whitton, and P. P. Tazik
4:00 - 4:20	Ecological aspects of Anodonta suborbiculata in Wisconsin. H. A. Mathiak
4:20 - 4:40	Revegetation of dredged material disposal sites - Pool 18, Mississippi River. J. Duyvejonck
4:40 - 5:00	Nutrient (N,P) and sediment dymanics of Lake Neshonoc, West Salem, Wisconsin. P. G. Ritter

Friday, 2 May, 1986

8:30 - 9:00	Business meeting. J. Peck
SESSION 5	Moderator: S. Lehtinen
9:00 - 9:20	Fate of a navigation pool on the Mississippi River. N. G. Bhowmik and J. R. Adams
9:20 - 9:40	Underwater foraging, time-activity budget, and sex ratio of canvasbacks staging during fall migration on Pool 7, Upper Mississippi River. J. Y. Takekawa, E. E. Klaas, and C. E. Korschgen
9:40 - 10:00	Effluent and ambient toxicity-testing of the metropolitan WWTP discharge and the Mississippi River receiving water, Minneapolis/ St. Paul, MN. K. Johnson
10:00 - 10:20	Coffee Break
SESSION 6	Moderator: R. Anderson
10:20 - 10:40	Bivalve mollusks of the St. Croix River near Hudson, Wisconsin. M. E. Havlik and D. J. Heath
10:40 - 11:00	The effect of simulated submersed vegetation density on Northern Pike predation behavior. S. J. Zigler
11:00 - 11:15	An overview of riverine bald eagle winter habitat. J. D. Ives, T. C. Dunstan, and G. Harper
11:15 - 11:30	The Upper Mississippi River as a bald eagle wintering system. T. C. Dunstan and E. Fawks
11:30 - 11:45	A description of habitat components and management techniques for bald eagles wintering along the Mississippi River. T. C. Dunstan, R. G. Harper, J.D. Ives, and D. L. Fisher
11:45 - 12:00	Bald eagles wintering near man-made structures along the Mississippi River near Burlington Iowa. D. S. Hopkins, R. G. Harper, and T. C. Dunstan
12:00 - 12:15	Bald eagle/fish spatial and temporal relationships at Lock and Dam 19. C. D. Hammond-Beyer, T. C. Dunstan, R. G. Harper, and B. R. Eichelschulte

ACKNOWLEDGMENTS

The following persons and institutions have contributed substantially to the planning, execution, support, and ultimately, the success of the 18th Annual Meeting. The 1985-86 Board of Directors gratefully acknowledges their involvement.

Meeting Arrangements

Carl E. Korschgen, Northern Prairie Wildlife Research Center
Karen L. Curtis, Columbia National Fisheries Research Laboratory

Mailing List, Newsletters, Program, and Registration

Denan M. Schumacher, Northern Prairie Wildlife Research Center
Karen L. Curtis, Columbia National Fisheries Research Laboratory
Janet H. Beitlich, Fish Disease Control Center
Barbara A. Deml, National Fishery Research Laboratory

Technical Session Moderators

James W. Eckblad, Luther College, Decorah, IA
David M. Kennedy, Wisconsin Dept. of Natural Resources, La Crosse
Thomas G. Coon, University of Missouri-Columbia
Leslie E. Holland, National Fishery Research Laboratory, La Crosse
James H. Peck, University of Arkansas-Little Rock
Richard V. Anderson, Western Illinois University, Macomb, IL

Assistance with Visual Aids

Ricky Lien, Luther College, Decorah, IA
Jay Mathis, Luther College, Decorah, IA
Linda Erickson-Eastwood, Iowa State University, Ames, IA
William L. Green, Northern Prairie Wildlife Research Center

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

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
			Executive Committee
15th	1982	Radisson Hotel, La Crosse	Dr. Richard V. Anderson Dr. David R. McConville Dr. James G. Wiener
16th	1984	Radisson Hotel, La Crosse	Dr. Kenneth S. Lubinski Ms. Rosalie A. Schnick Dr. Miles M. Smart
17th	1985	Radisson Hotel, La Crosse	Mr. Raymond C. Hubley Dr. John G. Nickum Ms. Pamella A. Thiel
			Board of Directors
18th	1986	Radisson Hotel, La Crosse	Dr. James W. Eckblad Dr. Carl E. Korschgen Dr. James H. Peck

CONSTITUTION
OF
MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

ARTICLE I. NAME AND OBJECT

1. This organization shall be named Mississippi River Research Consortium, Inc.

2. The objectives of this organization shall be:

   a. To establish and encourage communication between river scientists and between the scientific community and the public.

   b. To encourage pure and applied research concerning the water and land resources of the Mississippi River and its valley.

   c. To provide an annual meeting where research results can be presented, common problems can be discussed, information can be disseminated, and where river researchers can become acquainted with each other.

   d. To encourage cooperation between institutions and to encourage the sharing of facilities.

   e. To function as an advisory group to other agencies.

   f. To aid in the formation of a concerted and organized research effort on the Mississippi River.

ARTICLE II. ORGANIZATION

1. The organization of the Mississippi River Research Consortium shall be provided for by the enactment of suitable by-laws.

2. The by-laws of this organization shall designate the officers and standing committees, the provisions for the election of the officers, the conduct of meetings and for any other matters which are necessary for the government of this organization.

ARTICLE III. MEMBERSHIP AND DUES

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

ARTICLE IV. AMENDMENTS

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

BY-LAWS OF MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

ARTICLE I: NAME, PURPOSES AND DUTIES.

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

(a) To have the ultimate decision making authority for any and all affairs of the Mississippi River Research Consortium, Inc. which include but is not limited to the authority to create and terminate the corporation, to determine the budget and expenditure of funds, to manage affairs, to determine the manner, location and extent of services performed by the corporation, to determine the number of, location and job duties of any employees and to do all other and necessary work for the benefit of the corporation.

(b) To formulate all policies necessary for the effective and continuous operation of the corporation.

(c) To coordinate and make decisions regarding priorities of services.

1.02 The purposes of the organization shall be as follows:

(a) To establish and encourage communication between river scientists and between the scientific community and the public.

(b) To encourage pure and applied research concerning the water and land resources of the Mississippi River and its valley.

(c) To provide an annual meeting where research results can be presented, common problems can be discussed, information can be disseminated, and 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 2: OFFICES.

2.01 Principal and Business Offices.

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

2.02 Registered Office.

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

ARTICLE 3: BOARD OF DIRECTORS.

3.01 General Powers and Number.

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

3.02 Election and Term of Directors.

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

3.03 Regular Meetings.

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

3.04 Special Meetings.

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

3.05 Notice; Waiver.

Notice of such meeting of the Board of Directors shall be given by written notice delivered personally or mailed or given by telegram to each director at his/her home address or at such other address as such director shall have designated in writing with the secretary of the Board of Directors, in each case not less than ten (10) days prior to such meeting. Notices of special meetings must be given not less than two (2) days prior to such meeting. Whenever any notice whatever is required to be given to any director of the

corporation under the Articles of Incorporation or By-Laws or any provision of law, a waiver thereof in writing, signed at any time, whether before or after the time of the meeting, by the director entitled to such notice, shall be deemed equivalent to the giving of such notice. The attendance of a director at a meeting shall constitute a waiver of notice of such meeting, except where a director attends a meeting and objects to the transaction of any business because the meeting is not lawfully called or convened. Neither the business to be transacted at, nor the purpose, or any regular or special meeting of the Board of Directors need be specified in the notice or waiver of notice of such meeting.

3.06 Quorum.

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

3.07 Removal.

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

3.08 Conduct of Meetings.

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

3.09 Vacancy.

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

ARTICLE 4: MEMBERSHIP AND DUES.

4.01 Membership and Eligibility.

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

4.02 Membership and Dues.

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

ARTICLE 5: OFFICERS.

5.01 Creation of Officers.

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

5.02 Executive Director of the Corporation.

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

5.03 Election of Term of Office.

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

5.04 Removal.

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

5.05 Vacancies.

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

5.06 President.

The present shall:

(a) Act as chairperson of the Board and of any executive committee,

(b) Appoint all committees unless otherwise specified by the Board,

(c) Be executive on behalf of the Board of all written instruments except as provided or directed by the Board,

(d) Be responsible for the agenda to be used at the meeting,

(e) Perform all duties incident to the office of a president and such other duties as shall from time to time be assigned to him by the Board.

5.07 Vice-President.

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

5.08 Secretary-Treasurer.

The secretary-treasurer shall:

(a) Keep the minutes of the meetings of the Board,

(b) See to it that all notices are fully given in accordance with the provisions of the By-Laws,

(c) Be custodian of the records of the Board,

(d) Perform all duties incident to the office of the secretary of the Board, and such other duties as from time to time may be assigned by the president of the Board,

(e) Keep all financial records of the Board,

(f) Be responsible for record keeping and assessment of dues as established by the Board of Directors,

(g) Supervise the preparation of the annual budget,

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

5.09 Other Assistance to Acting Officers.

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

ARTICLE 6: COMMITTEES.

6.01 Nominating Committee.

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

6.02 Other Committees.

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

ARTICLE 7: MEETING OF MEMBERSHIP.

7.01 Annual Meeting.

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

7.02 Special Meetings.

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

7.03 Quorum.

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

ARTICLE 8: AMENDMENTS.

8.01 By The Membership.

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

ABSTRACTS FOR TECHNICAL PAPERS

Thursday and Friday

1-2 May 1986

Abstracts are listed in the order of presentation

COMMUNITY AND POPULATION CHARACTERISTICS OF MUSSELS IN THE BED AT ILLINOIS RIVER MILE 3.0-L

K. S. Lubinski
Pool 26 - River Research Laboratory
Illinois Natural History Survey
Grafton, IL 62037

We investigated the mussel community in the bed at Illinois River Mile 3.0-L to determine how its structure compared to beds in the Mississippi River and to record changes that might have occurred in this river reach over the last twenty years. The bed is commercially harvested and located on a submerged alluvial fan created by a short, high-gradient tributary. Quadrats (0.25 sq m) were searched in two nearshore zones (WZ1, WZ2) by wading, and in deeper water (DZ1) using SCUBA methods. Densities of live mussels per sq m were much greater in deep water ($\bar{X}$ = 25.6, n = 15 for DZ1) where the substrate included gravel and cobbles in a sand/clay matrix, than along the shore ($\bar{X}$ = 1.3, n = 349 for WZ1; $\bar{X}$ = 1.1, n = 178 for WZ2), where a layer of silt between 1 and 5 cm in depth covered the substrate. Maximum density in DZ1 (33.6 live mussels per sq m) was similar to levels reported for Mississippi River beds. From an estimated bed size of 15,000 sq m, we calculated that the total number of live mussels in bed was approximately 360,000. Live individuals of 16 species were collected. Cumulative species per sample curves indicated that thresholds were reached in WZ1 and WZ2 but not DZ1. Species composition was similar to that reported for this river reach in 1966. Exceptions included the presence of the Asiatic clam, Corbicula fluminea, and black sandshell, Ligumia recta, which had been reported eliminated, and the absence of hickorynut, Obovaria olivaria. Live/Dead ratios in WZ1, WZ2 and DZ1 were 0.67, 0.56 and 0.69, respectively. A Recent Dead/Old Dead ratio calculated for 8 quadrats in DZ1 was low (0.04), suggesting recent summer die-offs have not occurred in the Illinois River, in contrast to the Mississippi River.

NONGAME MONITORING NEEDS ON THE UPPER MISSISSIPPI RIVER

Michael J. Mossman
Bureau of Endangered Resources
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, WI 53707

The Upper Mississippi River is unique among midwest ecosystems, and contains important populations of many nongame and endangered animal species. These populations should be inventoried and monitored to evaluate the effects of management practices and other environmental changes on this system, and to indicate sites for special protection or management. Although various agencies have monitored certain sites, for example individual heron colonies, these efforts are inadequate because of a lack of coordination, standardization, long-term planning, and the ability of populations to shift breeding sites between years. However, recent surveys of nongame birds, frogs and mussels have provided important data and suggest the requirements, techniques, and general scheme for a coordinated long-term inventory and monitoring program.

GEOMORPHOLOGICAL ASPECTS OF LONG-TERM ECOLOGICAL RESEARCH IN THE UPPER MISSISSIPPI RIVER BASIN

Holden, Mary E., Deborah I. Casavant, David L. Gross,
Mark D. Grubb, Suzanne M. Orbock Miller,
and Michael V. Miller
Illinois State Geological Survey
615 East Peabody Drive
Champaign, IL 61820

As part of the Long-Term Ecological Research (LTER) program of the U.S. National Science Foundation, portions of the Mississippi and Illinois Rivers are being studied in order to produce an integrated model of fluvial ecosystems which incorporates the diverse fields of ecology, geomorphology, and hydrology. Geomorphological studies conducted by the Illinois State Geological Survey aid in identification of physical factors which influence the distribution of aquatic communities. Recent research activities have focused on sedimentation within large navigation pools in the Upper Mississippi River. Casavant (1985) reported a downstream fining trend within Pool 19 of the Mississippi River and evidence of fine-grained sediment accumulation in backwater and main channel border areas. In contrast, study of Mississippi River Pool 26 by Goodwin and Masters (1983) shows no downstream fining trend in the pool upstream of the Illinois River-Mississippi River confluence. Similarly, sedimentological analyses on thalweg bottom sediments between Pools 19 and 26 exhibit no trends in grain size.

Proposed geomorphological research is focused on the refinement of previous sedimentological studies. Geomorphological research will also identify and evaluate the spatial and temporal distribution of geomorphic units as well as additional physical factors which influence biotic community structure and function (Vannote, et al., 1980; Fisher, 1983; Cummins, et al., 1983). Relationships between the physical parameters and biologic productivity within the system can then be evaluated. Compilation of biological, geological, and hydrological data can be incorporated into a multi-component framework to model the long-term ecology of the fluvial system.

SEDIMENTATION PATTERNS IN QUINCY BAY

J. Rodger Adams, William C. Bogner, and Frank S. Dillon
Illinois State Water Survey
2204 Griffith Drive
Champaign, IL 61820

Quincy Bay has been modified by three structural changes: completion of Lock and Dam 21 in 1938, dredging for fill for a new railroad embankment in 1959, and opening of a new access channel in 1969. The dam has a maximum lift of 3.2 m and raised the low water level about 3.5 m. This increased water depths in Quincy Bay and created new backwaters and sloughs in the bottoms between the Mississippi River and Quincy Bay proper. When the railroad crossing was relocated in the late 1950s, sand was dredged from the backwater area for the new embankment. This formed an open water area of about 11 hectares with a depth of over 7 m. The access channel was constructed to allow large boats to pass between Quincy Bay and the river by a more direct route.

By 1975, Broad Lake was perhaps 2 m deep and several sloughs were not navigable by small boats at normal pool level. Scour in the access channel now has increased its depth from 1.5 to 7 m. Large quantities of water and sediment enter the bay through the access channel and some of the sediment is deposited in the bay.

Present depths of water and sediment are reported for the access channel, various parts of the bay, and the outlet channel. Bottom material characteristics confirm channels, deposition sites, and intermediate zones. The channels have sandy bottoms, while the more lake-like areas have clay-silt bottoms.

FISH PASSAGE THROUGH DAMS ON THE UPPER MISSISSIPPI RIVER

Daniel B. Wilcox
Environmental Resources Branch
U.S. Army Corps of Engineers, St. Paul District
1135 U.S. Post Office and Custom House
St. Paul, MN 55101

Adult fish of nine species are known to undergo movements through dams on the Upper Mississippi River (UMR). Design characteristics of UMR navigation dams allow both upstream and downstream fish passage. Upstream fish passage is dependent upon hydraulic conditions at the dam, fish behavior, and swimming performance. Physical hydraulic modelling of current patterns through UMR dam gates and analysis of swimming performance of several UMR fish species indicate that opportunity for upstream fish passage occurs at lock and dam 8 during most water years. Operation of hydropower units at UMR dams may decrease opportunity for upstream fish passage.

THE STABILIZATION OF DREDGE SPOIL WITH AMERICAN BEACHGRASS

Thomas O. Claflin[1] and James H. Peck[2]
[1]River Studies Center, University of Wisconsin-La Crosse
La Crosse, WI 54601
[2]University of Arkansas-Little Rock, Department of Biology
33rd and University, Little Rock, AR 72204

American Beachgrass (Ammophila breviligulata) was introduced to Island 117 (Brownsville, MN) in Pool 8 of the Upper Mississippi River during the summer of 1975. The specimens were planted by hand in three parallel rows about 80 m in length and 10 m apart on the backwater side of the island. The rates of growth and the effects of the beachgrass upon the environment were assessed during the summer of 1985. By that time, the beachgrass had formed a cover over an area of approximately 1 hectare and attained densities exceeding 200 g/m^2 at several locations. The presence of beachgrass influenced the physical environment within the plot. The sand sediments within the plot were significantly finer than in the unvegetated control area. Soil moisture at the surface and at 10 cm in depth was also higher within the plot. Surface temperatures in the plot were lower than in the control area. The invasion of native plant species was evident, particularly near the edges of the beachgrass stand. In addition, there is considerable evidence that ground dwelling insects, rodents and burrowing mammals use the area. It is evident that the introduction of this species has had beneficial wildlife effects as well as ameliorating the physical environment.

EARLY LIFE HISTORY OF CHANNEL CATFISH IN NAVIGATION POOL 7 OF THE UPPER MISSISSIPPI RIVER

Michael C. Duval
Biology Department
University of Wisconsin-La Crosse
La Crosse, WI 54601
and
Leslie E. Holland
U.S. Fish and Wildlife Service
National Fishery Research Laboratory
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Channel catfish (Ictalurus punctatus) is a major commercial species in the upper Mississippi River. However, concern exists over its status in many areas of the river. Poor recruitment and/or over-exploitation may be occurring. Few data exist to evaluate recruitment of this species in the system. A study was designed to examine spatial and temporal distribution patterns, daily age and growth relationships, and food habits of young-of-the-year (YOY) in Navigation Pool 7. Fish (15-83 mm SL) were collected by otter trawl at night during summer 1984 and 1985. There was no significant difference in catch by station. Also, size of fish varied little between stations. However, in 1984, significantly smaller fish were collected from the main channel area associated with a large backwater-tributary input. In 1985, significantly smaller fish were collected approximately 1.6 km downstream of this backwater area at a constriction of the main channel. This backwater area may be an important spawning habitat or at least an important early nursery habitat from which YOY are recruited to the main channel. Two peaks in the 1984 length-frequency distribution data suggested two separate spawning events in the pool or rather a disruption in spawning correlated with a rapid doubling of river discharge in late June. Analyses of age distributions as determined by examination of sagittae and verified in laboratory studies have supported this hypothesis. Growth of YOY was relatively uniform throughout the pool with fish growing at an approximate rate of 1.0 mm per day. However, growth became more variable with age, particularly after 50 days post-hatch. Food items varied little among fish or between sampling stations (Trichoptera >> Cladocera > Diptera). Smaller individuals consumed food types that were common in the drift, while larger individuals switched to a benthic feeding pattern as evidenced by sand grains in stomachs. This behavioral change dramatically affected the catchability of YOY. All regions of the main channel appear to be of equal value as channel catfish nursery habitat. In addition, discharge appears to be a major factor influencing spawning of channel catfish and distribution patterns of YOY.

EVALUATION OF LONG-TERM CHANGES IN AQUATIC MACROPHYTE DEVELOPMENT USING HIGH ALTITUDE AERIAL PHOTOGRAPHY - METHODS AND RESULTS

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As a result of siltation, extensive aquatic macrophyte beds have developed in the lower reaches of Pool 19. Aerial photographs from 1927 to 1985 were used to assess the extent of development of submergent macrophytes, Nelumbo lutea, and Sagittaria spp. in 4 major areas of the Pool. Due to variation in RF scales ranging from 1:6000 to 1:20000, comparisons were made between field-truthed areas to evaluate potential differences due to scale. Additionally, 3 methods; the dot method, cut and weigh using paper tracing, and an electronic planimeter were used to assess methodological error. Macrophyte development since 1927 was found to be expontential in most areas examined. However, thresholds for each major type of macrophyte did occur and were dependent upon successional sequence of development within a bed.

THE USE OF ELECTROPHORETIC TECHNIQUES TO EVALUATE POPULATION RELATIONSHIPS IN MUSSELS OF POOL 19

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Due to high densities of common species of mussels, Ambelma plicata and the Quadrula group, mussel communities are usually quite similar based on similarity indices. When the common species were evaluated genetically, differences between relative movement of the two species was found. Gene flow between populations of Ambelma plicata and Quadrula quadrula above and below Lock and Dam 19 was comparatively low. This indicates the dam may act as a barrier. Among A. plicata populations within Pool 19 gene flow is greater than among Q. quadrula populations. The role of host fish in larval movement may cause this difference.

THE IMPORTANCE OF BORROW PITS TO FISH POPULATIONS IN THE UPPER MISSISSIPPI RIVER VALLEY

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We evaluated the importance of borrow pit habitats to fish species commonly found in the upper Mississippi River backwaters. Two borrow pits connected to the South River were sampled by electrofishing in May, June, and July of 1984. Thirty-two species were collected from the borrow pits with twenty-seven species represented in each. Largemouth bass, white crappie, gizzard shad, bluegill, and carp made up greater than eighty percent of the total sample. Percent stock densities (PSD) of largemouth bass and bluegill were 29 and 17 respectively and are considered low by most standards. The white crappie PSD value was higher (63) and reflects a well balanced population. Wr's (relative weights) for largemouth bass ($\bar{x}$ = 111) and bluegill ($\bar{x}$ = 116) were very good while Wr's for white crappie were good ($\bar{x}$ = 94). The presence of high numbers of young-of-the-year fish showed that the borrow pits are productive spawning and nursery areas for species which typically use backwater habitats for these purposes. The data collected in this study indicate that borrow pits can provide excellent fish habitat. The development of such borrow pits in streams undergoing channelization may alleviate some of the negative factors associated with channel habitat losses.

THE HERPETOFAUNA OF THE WEAVER DUNES

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The Weaver Dunes is an area of rolling sand dunes, blowouts, and prairie located on an alluvial terrace adjacent to Pool 5 of the Upper Mississippi River in Wabasha County, Minnesota. Its herpetofauna can be divided among (a) typical sand-dwelling species (e.g., Pituophis melanoleucas, Heterodon platyrhinos, and H. nasicus), (b) wide-ranging species found in a variety of habitats (e.g., Thamnophis sirtalis), (c) species associated primarily with small ponds scattered among the dunes (amphibians and turtles), and (d) nesting turtles that migrate from adjacent wetland and backwater systems. I found evidence for substantial mortality to nesting turtles of two species (Chrysemys picta and Graptemys geographica), probably due to predation. A comparison with the herpetofauna of a superficially-similar habitat on an old alluvial terrace of the Wisconsin River (the Spring Green Reserve in Sauk County, Wisconsin) revealed several differences. Some of these are attributable to the isolation of the Weaver Dunes from rocky bluff habitat by intervening wetlands and to the greater distance of the Spring Green Reserve from aquatic habitats, but the absence of six-lined racerunners (Cnemidophorus sexlineatus) from the Weaver Dunes is problematic.

A QUANTITATIVE MUSSEL SURVEY AT PRAIRIE DU CHIEN, WISCONSIN: YEAR 2

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In a second year of quantitative mollusc studies, 116 0.25 sq m substrate samples were collected by divers at four sites in the East Channel of the Mississippi River near Prairie du Chien, Wisconsin. Approximately 1900 bivalves, representing 30 species including Corbicula fluminae, were collected, weighed and measured in July, 1985. Amblema plicata and five other species comprised 78.7% of the community; 17 species, including the endangered Lampsilis higginsi, each comprised less than 1% of the unionids. There were no significant differences (Duncan's Multiple Range Test, 0.05 level) in density of adult or juvenile A. plicata in the East Channel of the river between July, 1985 and October, 1984, the time of the first survey. Approximately 20 quantitative samples are necessary to characterize the community at a site; variance to mean ratios for densities of A. plicata ranged from 1.5 to 5.6 reflecting patchiness within the bed. Total bivalve density and species richness were low at a barge turning zone (27.3/sq m, 20 species), high at a site downriver (148.8/sq m, 28 species), and reduced at a site that was dredged in 1976 (2.8/sq m, 9 species). Adult densities for A. plicata averaged 4.5/sq m in the turning zone and 61/sq m at the downriver site. However, juvenile (defined as 35 mm or less in length) A. plicata averaged 4.7/sq m at the turning zone and 4.4/sq m at the downriver site. There was no evidence of recent recruitment in the dredge area.

THE EFFECTS OF MACROPHYTE BEDS ON MACROINVERTEBRATE COMMUNITIES AND ISLAND DEVELOPMENT

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A macrophyte bed in the lower reaches of Pool 19 was examined for seasonal changes in plant species composition, succession of macroinvertebrates with bed formation, and effects of bed development on water depth. Species composition in the bed changed from a diverse, codominant assemblage of submerged macrophytes to a relatively homogenous Vallisneria americana community late in the growing season. The macroinvertebrate community shifts from a predominantly benthic to a lotic type as the age of the macrophyte bed increases. Sedimentation rates are higher and consequently water depth much lower in the upstream end of the macrophyte bed. As a result a crescent shaped island is predicted to develop in the area of the present macrophyte bed.

ECOLOGICAL ASPECTS OF ANODONTA SUBORBICULATA IN WISCONSIN

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Live Heel Splitter, Anodonta suborbiculata, were not found in Wisconsin until 1977 as reported by Havlik. They are not easy to find because of their preference for soft, silty substrates. A three-tined hay fork covered with one-inch welded fabric was used to sample the silt. A total of 102 live specimens were found, by far the majority of them were in association with the White Water Lily, Nymphaea odorata or American Lotus, Nelumbo lutea. Live Heel Splitters were found close to the edge of beds of these plants while they were essentially absent 10-15 feet away in open water. A few were found in the beds but the numerous long petioles of these plants made it difficult to locate the clams.

One small bay had a single bed of Lotus. No Heel Splitters were in or close to the bed. This was an exception, however, since I found dead and live clams farther away in open water. Another variation was found in a slough in the Wisconsin River which had no Lotus or Lily beds. Here both live and dead Heel Splitters were found in open water but only 40 feet or more from a large tree which had fallen into the slough years ago. That tree must have been much larger when it fell, consequently putting the clams much closer to the special fish cover then when I found them a few years later.

Anodonta grandis, the Floater, was also commonly found in silt areas and outnumbered all other species of mussels put together. Knowledge of the close connection between the Heel Splitter and Lily or Lotus beds in Wisconsin should make it much easier to find this mussel which has eluded collectors for so many years.

REVEGETATION OF DREDGED MATERIAL DISPOSAL SITES - POOL 18, MISSISSIPPI RIVER

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The Mississippi River 9-Foot Channel Navigation Project requires annual dredging and disposal of dredged material. Occasionally, material is placed in forest-floodplain locations due to a lack of other suitable disposal sites. Depending upon the death and frequency of disposal, these sites can become sterile sand mounds several acres in size. In 1982, RID began experiments to determine inexpensive and foolproof methods to revegetate these sites for wildlife benefits. A variety of mulches and techniques were used to plant shrubs and native grasses. Straw, excelsior mat (erosion control mats), cut willow branches, and horizontally laid snow fence were used as mulches. The effectiveness of the mulches appeared more related to its effectiveness in reducing ground surface temperatures (shading) and (or) enhancing soil moisture retention than any nutrient benefits. Panicum virgatum (Switchgrass) and Bromus inermus (Smooth Brome Grass) were the most successful colonizers of dredged material sites. All grass plots not having a mulch cover failed to show any germination and growth, except for Ammophila breviligulata (American Beachgrass) which was very successful. Bare rooted seedlings were also planted using various combinations of moisture holding agents, mulches and silty loam soil from adjacent woods. Shrubs planted without any moisture retaining media showed a 100 percent mortality rate. Seedlings planted with a small amount of soil mixed in the sand substrate were somewhat successful. Shrubs planted where sand depth 3 feet or less and occasionally flooded for brief periods showed excellent growth due to silt deposition.

NUTRIENT (N,P) AND SEDIMENT DYNAMICS OF LAKE NESHONOC, WEST SALEM, WISCONSIN

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Lake Neshonoc is a reservoir (243ha) on the La Crosse River in the Driftless Area of southwestern Wisconsin. Water and sediments were collected from the four influent waters, the marsh upstream from the lake, four sites within the lake, and one site downstream from the dam. Deep water sites in the lake were sampled at the surface, middle, and near-bottom of the water column. Water samples were analyzed for temperature, dissolved oxygen, pH, total alkalinity, conductivity, total non-filterable and volatile residues, chlorophyll a, total phosphorus, ortho-phosphorus, ammonia, nitrite, and nitrate. Sediments were analyzed for total nitrogen and total phosphorus. Samples were collected from all sites during February through September, 1985, at which time the lake was drained for dam repairs. Influent samples were collected through December, 1985.

Total alkalinity, pH, and conductivity were typical of a well-buffered lake. Dissolved oxygen in the lake became depressed to 2.5 ppm during the summer months but returned to an orthograde condition within two weeks. Of the influent waters, Adam's Valley Creek consistently had the highest nutrient concentrations. As the water flowed through the lake about 10% of the nitrogen and phosphorus were removed through biological uptake and/or sedimentation. The lake lost ca 11% of its volume and ca 13% of its surface area during the past 20 years due to encroachment of the marsh area. Improvements in watershed management must be implemented to prolong the benefits of this reservoir.

FATE OF A NAVIGATION POOL ON THE MISSISSIPPI RIVER

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Humans have altered streams and rivers for their economic, commercial, and recreational uses. Construction of locks and dams in large rivers is an alteration in which low flow depths have been increased to facilitate the movement of river traffic such as barges and tows. Pool 19 on the Mississippi River near Keokuk, Iowa, is the oldest and one of the two highest dams on the Mississippi River. The high storage-capacity-to-inflow ratio causes a high trap efficiency for this pool. This results in a predictable pattern of change in the morphometric parameters of the river. The pool is going through a successional change and ultimately will attain a dynamic volumetric equilibrium with an extensive formation of islands, shallow channel border areas, and plant beds. Interactions between the river and its tributaries at their confluences have also changed. Confluences are now more like estuaries then river junctions. The formation of deltas, islands, and shallow wetlands near the confluences are the end products of these changing interactions. The dam has changed the Des Moines Rapids into a shallow, biologically productive pool, with extensive beds of submergent aquatic macrophytes and burrowing macroinvertebrates, which attract migratory waterfowl and fish. As the pool continues to approach volumetric equilibrium, these beds will change to marsh and floodplain vegetation, and will eventually occupy only one-third the area they do now. Similar successional changes are expected to occur in most of the temperate rivers of the world as more and more rivers are being dammed for flood control, water supply, irrigation, power generation, or recreational uses.

UNDERWATER FORAGING, TIME-ACTIVITY BUDGET, AND SEX RATIO OF CANVASBACKS STAGING DURING FALL MIGRATION ON POOL 7, UPPER MISSISSIPPI RIVER

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Deterioration of staging resources in Minnesota, Wisconsin, and Illinois during the past two decades concurrent with proliferation of American wildcelery (Vallisineria americana) on the Upper Mississippi River has resulted in increased numbers of canvasbacks (Aythya vallisneria) using Upper Mississippi River pools. Wildcelery is a traditional resource of this species, and winter buds are the major food consumed by the heavy concentration of birds using Pools 7, 8, and 9. This paper describes observations of canvasbacks staging on Lake Onalaska near La Crosse, Wisconsin and research on the foraging efficiency of captive birds diving in a pool at the National Fishery Research Laboratory.

In laboratory trials, underwater foraging behavior may be studied under conditions where resource densities can be controlled. Winter buds are planted in a large sand substrate at densities ranging from 3 to 130 buds per square meter. Canvasbacks are able to consume more winter buds as the density increases, but fewer buds are taken the deeper they are planted in the substrate. The birds consume between 77 and 432 winter buds per hour given the range of trial densities. A Holling model estimate predicts their maximum consumption at nearly 600 buds per hour. Males are more efficient than are females at obtaining winter buds.

Scan samples of birds foraging on the lake indicates that males dive for a longer time than females, and both sexes spend over five hours each day diving for food. Canvasbacks appear to spend more time foraging at night. Based on night vision scope observations, more than 35 percent of all foraging occurs at night. This indicates the birds do not need to use visual cues to find their food. Other major behaviors recorded include sleeping, swimming, preening, and resting.

Aerial photography of birds using Lake Onalaska reveals that more than 80 percent of the birds are males. The proportion of males varies from 76 to 96 percent during the 500,000 use-days observed annually on the lake. Although canvasbacks are known to have a highly skewed sex ratio, these findings are surprising because the fall flight should include newly recruited birds with a more even sex ratio. Three possibilities may explain the results: more males use the Upper Mississippi, females travel through the area faster, or female mortality is high on the breeding grounds or early in fall migration.

EFFLUENT AND AMBIENT TOXICITY-TESTING OF THE METROPOLITAN WWTP DISCHARGE AND THE MISSISSIPPI RIVER RECEIVING WATER, MINNEAPOLIS/ST. PAUL, MN

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In the Minneapolis/St. Paul, MN area, the Metropolitan Waste Contol Commission (MWCC) operates 13 wastewater treatment plants (WWTPs) which discharge to 4 major rivers. Of these 13 facilities, the Metropolitan (Metro) WWTP in St. Paul is the largest, discharging 222 million gallons of wastewater per day (mgd) to the Mississippi River.

Since 1982, upgrades at the Metro WWTP have resulted in a continuing improvement in effluent quality. Implementation of the Industrial Waste Contol (Pretreatment) Program (1982), use of nitrification for ammonia removal (1984), expansion of secondary aeration and clarification capacity (1985), a comprehensive plant optimization study (1985), and addition of dechlorination facilities (1986) will ensure that advanced secondary effluent limitations for $CBOD_5$, NH_3, chlorine residual, Cd, Cu, Hg, and cyanide, effective in 1985-86, will be met until expiration of the current NPDES Permit (1987). The new NPDES Permit will contain water quality-based effluent limits (WQBEL's) to ensure that water quality standards will be met.

To evaluate the improvement in effluent and receiving water quality as a result of these plant upgrades, effluent and ambient (instream) toxicity-testing was conducted during 1984-85, using representative aquatic organisms. In both 1984 and 1985, Metro effluent was evaluated using 96-hour flow-through tests with fish and 48-hour static renewal tests with Daphnia magna. These toxicity tests revealed that Metro effluent was not acutely toxic to the test organisms; no organism mortalities occurred in 100% effluent. Chemical analyses of the effluent, conducted simultaneously with the toxicity tests, showed that concentrations of all NPDES-permitted parameters were substantially less than the effluent limits in effect at that time. Concentrations of these parameters in 1985 were also less than the WQBEL's currently proposed by the MPCA (subject to revision). In 1984, chronic instream toxicity-testing was conducted to determine the survival and reproductive capability of Daphnia magna in receiving waters obtained above and below the Metro WWTP discharge. Daphnia survival at all receiving water sites was greater than or equal to that in the control, and reproductive capability (young/female) was substantially greater. Chemical analysis of the receiving water showed that concentrations of ammonia, selected metals, and cyanide were less than the corresponding water quality criteria or standards at all sites.

Toxicity-testing results have indicated that, at present treatment plant operating efficiency, the quality of Metro effluent is very good, and receiving water impacts may be minimal.

BIVALVE MOLLUSKS OF THE ST. CROIX RIVER NEAR HUDSON, WISCONSIN

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A bivalve mollusk survey was conducted July 1985 at St. Croix River Mile 17.4, Hudson, WI, prior to the burying of a cable. Fourteen sites on a transverse transect were sampled quantitatively and qualitatively by SCUBA diving resulting in 707 living naiades (22 species); 7 additional naiad species were represented by empty shells. Two live Lampsilis higginsi were found; empty shells of L. higginsi at 8 of the sites along the 1700 foot transect indicated a fairly high potential for living specimens throughout the proposed project site. Overall low densities (1.9 live naiades per m^2) and sandy substrate made the area an ideal site for removal of all live naiades immediately prior to the burying of the cable. In October 1985, 626 additional living naiades (16 species), including 5 more L. higginsi, were removed from a 10 foot wide path along the transect just prior to laying of the cable. Five of the L. higginsi were marked with a number on both valves and transplanted a short distance upstream. Amblema p. plicata (including about 150 specimens not removed from the substrate) represented 45.9%, Fusconaia flava 19.4%, and Obliquaria reflexa 13.7% of the naiades found. Eighteen of the species, including L. higginsi at 0.5%, represented less than 1% each of the total found during both portions of the study (1488 specimens, including 25 living species and 4 species represented by empty shells). This compares similarly to the naiad species distribution in the Mississippi River. The exotic Corbicula fluminea was also found alive.

THE EFFECT OF SIMULATED SUBMERSED VEGETATION DENSITY ON NORTHERN PIKE PREDATION BEHAVIOR

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Aquatic vegetation density was examined as a factor in determining northern pike (Esox lucius) predator capabilities. Predator-prey interactions between northern pike and fathead minnows (Pimephales promelas) were studied under laboratory conditions in circular pools of 1.2m diameter and 0.03m depth. Artificial plant stems attached to weighted plastic grids at densities of 0, 100 and 250 stems/m^2 provided a means of varying habitat complexity. Fathead minnows were released into pools containing each artificial stem density and the resulting experimental trials were videotaped. Northern pike behavior was divided into five mutually exclusive behaviors, inactivity, search, pursuit using paired fin propulsion, pursuit using median fin propulsion and capture attempts. The duration and number of times each behavior occurred as well as strike distance and capture efficiency were quantified through the analysis of the videotape. Data showed significant shifts in northern pike predation behavior patterns with increasing stem density. For example, northern pike became more sedentary at the highest stem density as compared to the low stem densities. The time spent using paired fin propulsion and at rest increased dramatically at 250 stems/m^2. Additionally, the distance covered in capture attempts decreased as stem density increased. This information could have significant implications in the management of aquatic macrophytes.

AN OVERVIEW OF RIVERINE BALD EAGLE WINTER HABITAT

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Riverine habitat for wintering bald eagles was studied at a number of locations along the Mississippi and Illinois rivers in Illinois. Wintering eagles use trees as perches during four major activities. Preferred tree species, tree age, and growth form used for any of the four activities were similar. The availability and location of the potential perch trees in relation to the proximity of the activity areas determined relative use. The four major eagle activities were foraging, eating, resting, and night roosting. The preferred floodplain species used for these activities was cottonwood. The most frequently used upland species along bluffs used for resting and in night roosts were oak species and silver maple. Adverse impacts on these habitats included barge fleeting, erosion, timber cutting, and construction activities.

THE UPPER MISSISSIPPI RIVER AS A BALD EAGLE WINTERING SYSTEM

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Since the late 1800's the upper portion of the Mississippi River has been documented as a wintering area for bald eagles (Haliaeetus leucocephalus). Early records document the use of the river by eagles searching for food in areas with open water in winter. After construction of the navigation locks and dams between St. Louis, Missouri and Minneapolis/St. Paul, Minnesota vast areas of the river that once had open water in winter due to natural springs, meanders and current action, and waterfalls were frozen closed and as a result greatly limited accessiblity to the fish food resource needed by eagles. Since the 1930's and the construction of 27 locks and/or dams, eagles have gathered annually in large numbers to forage in the open tailwaters while scavenging drifting fishes, primarily gizzard shad (Dorosoma cepedianum), freshwater drum (Aplodinotus grunniens), channel catfish (Ictalurus punctatus), and Hiodon spp.. Annual eagle populations within the study area have ranged between 1100 and 2000 individuals. Eagle concentrations found at particular locks and dams also vary annually and appear to be influenced by regional winter weather conditions. Preferred habitat used by eagles has been protected for decades via state and federal refuge systems established for multiple species use. Since 1970 and the establishment of the Cedar Glen Eagle Roost complex specifically for bald eagles, additional private lands have been acquired with both the terrestrial and aquatic environs managed for bald eagles. The Mississippi River is a key component in the life cycle of this endangered species and the well-being of the bald eagle will be echoed in relation to the quality of the river system.

A DESCRIPTION OF HABITAT COMPONENTS AND MANAGEMENT TECHNIQUES FOR BALD EAGLES WINTERING ALONG THE MISSISSIPPI RIVER

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The Mississippi River is a major wintering area for bald eagles (Haliaeetus leucocephalus) in the contiguous United States. Four eagle habitat components were identified at wintering sites which are used for foraging, eating, resting, and night roosting. Bald eagles are primarily fish eaters, and foraging habitat usually consists of large cottonwoods along the banks of the river. Eating habitat is where eagles consume fish, usually in large cottonwoods or silver maples located away from the river. Resting habitat, which is also located away from the river, is in a sunny area protected from the wind where eagles rest during the day. Eagles roost at night in large bowl-shaped ravines in the river bluffs, and on wooded flood plains and islands along the river. From 1970 to 1986 management techniques for enhancing these habitat components along this important ecosystem have been developed and/or applied. A basic management strategy document was developed from data gathered along 840 miles of the Mississippi River from Minnesota to Kentucky. Applied management techniques include supplemental perches, tree transplants, forest modification, signing, and the use of riprap and dikes.

BALD EAGLES WINTERING NEAR MAN-MADE STRUCTURES ALONG THE MISSISSIPPI RIVER NEAR BURLINGTON IOWA

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Distribution of wintering Bald Eagles (Haliaeetus leucocephalus) along a 15 mile section of the Mississippi River near Burlington, Iowa was assessed by observations conducted during January 1984 to March 1984 and December 1984 to March 1985. Bald Eagles congregated near areas of open water provided by man-made structures during periods of maximum ice cover. Bald Eagle distribution was more uniform along the river during ice-free conditions. Man-made structures within or along the river study area included Lock and Dam 18, wing dams, bottomland pumping stations, a sewage treatment plant, and a coal fired power plant. Foraging efficiency, proximity to night roosts, and proximity to human disturbance are compared at locations of each man-made structure. Management considerations for Bald Eagles wintering along this section of river include: reducing human disturbance, habitat protection, and monitoring input of toxic substances.

BALD EAGLE/FISH SPATIAL AND TEMPORAL RELATIONSHIPS AT LOCK AND DAM 19

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The construction of Lock and Dam 19 in 1913 eliminated the Des Moines rapids, an area historically used by wintering bald eagles. The dam created new habitat and open water areas in winter which has been subsequently utilized by wintering bald eagles (Haliaeetus leucocephalus). This site has been studied by the Western Illinois University Eagle Research Team since 1970. Foraging patterns, feeding attempts and prey size of fishes have been quantified. However, fish species, availability, and numbers used by eagles for food have not been well studied. A pilot project during the winter of 1984-85 documented a winter die-off of gizzard shad (Dorosoma cepedianum) beginning 27 January 1985. Current research uses a visual transect method to identify fish species and numbers in the drift. Current patterns and drift lanes in the pool were determined by float studies. Age/size histograms and population estimates for gizzard shad for the plunge pool area below the lock and dam were determined by fall fisheries investigations. Collection of winter mortality samples will indicate age and size classes most susceptible to eagle predation. Multivariate analysis of eagle population data, visual transect observations and environmental conditions is being performed to better understand winter distribution and habitat utilization.