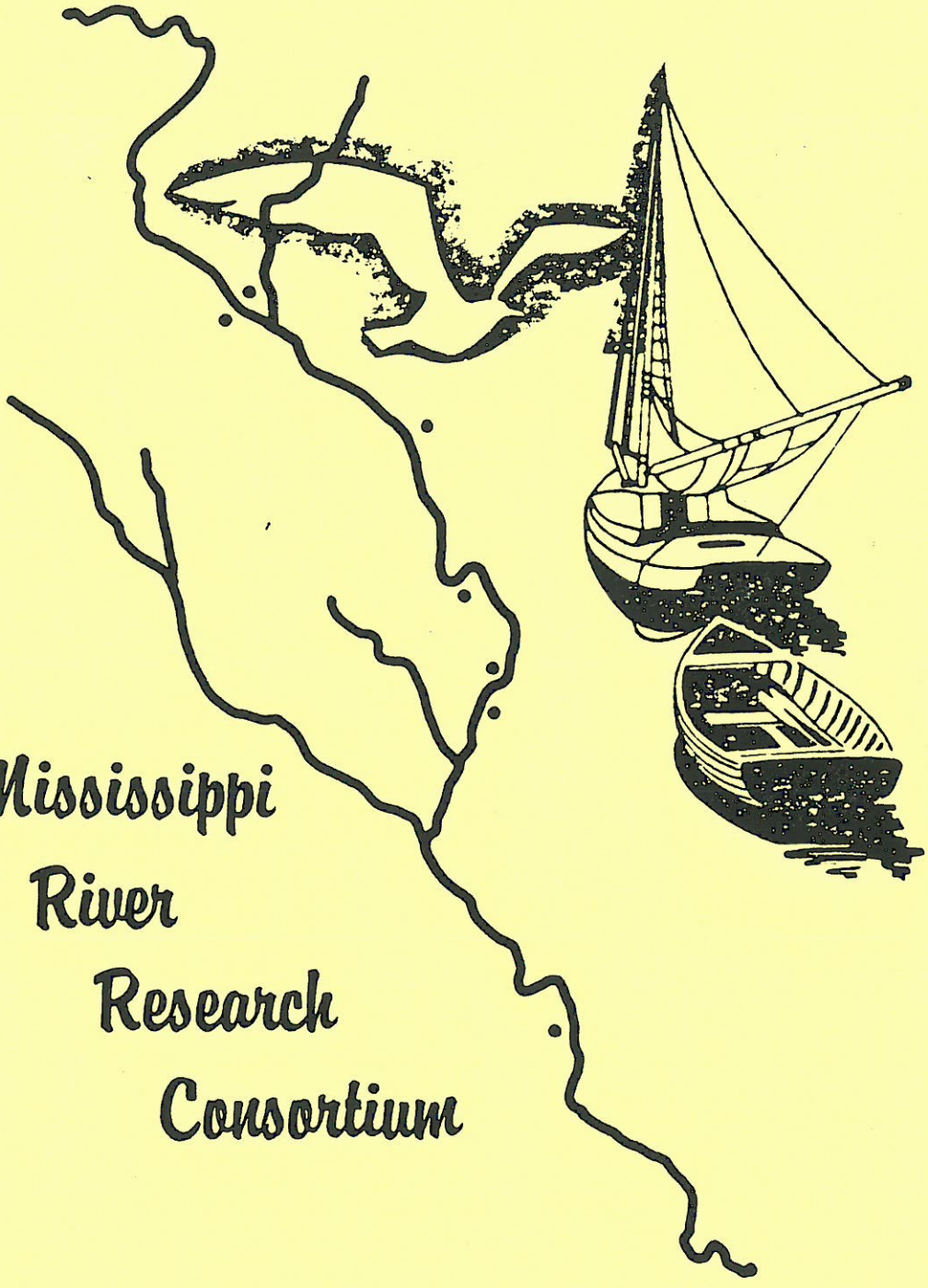

Mississippi River Research Consortium

16th Meeting
April 18-20, 1984
La Crosse, Wisconsin

16th MEETING

MISSISSIPPI RIVER RESEARCH CONSORTIUM

18-20 April 1984

La Crosse Radisson Hotel

La Crosse, Wisconsin

Executive Committee:

Dr. Kenneth S. Lubinski
Ms. Rosalie Schnick
Dr. Miles M. Smart

Contents Page

PAST MEETINGS AND OFFICERS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

Meeting	Year	Place	President
1st	1968	St. Mary's College, Winona	Brother George Pahl
2nd	1969	Wisconsin State University, La Crosse	Dr. Thomas Claflin
3rd	1970	Winona State College, Winona	Dr. Calvin Fremling
4th	1971	St. Cloud State College, St. Cloud	Dr. Joseph Hopwood
5th	1972	Loras College, Dubuque	Dr. Joseph Kapler
6th	1973	Quincy College, Quincy	Rev. John Ostdiek
7th	1974		
8th	1975	Monmouth College, Monmouth	Dr. Jacob Verduin
9th	1976	St. Mary's College, Winona	Mr. Rory Vose
10th	1977	Winona State University, Winona	Dr. Dennis Nielsen
11th	1978	University of Wisconsin-La Crosse	Dr. Ronald Rada
12th	1979	Cancelled	Dr. Edward Cawley
13th	1980	Loras College, Dubuque	Dr. Edward Cawley
14th	1981	Ramada Inn, La Crosse	Mr. Michael Vanderford
			Executive Committee
15th	1982	La Crosse Radisson Hotel	Dr. Richard V. Anderson Dr. David R. McConville Dr. James G. Wiener
16th	1984	La Crosse Radisson Hotel	Dr. Kenneth S. Lubinski Ms. Rosalie Schnick Dr. Miles M. Smart

ACKNOWLEDGMENTS

The following persons and institutions have contributed substantially to the planning, execution, support, and ultimately, the success of the 16th MRRC Meeting. The Executive Committee gratefully acknowledges their involvement.

Meeting Arrangements and Liason with Radisson

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

Mailing List, Newsletters, Program, and Registration

Karen L. Curtis, Columbia National Fisheries Research Laboratory
Carol Hornung, National Fishery Research Laboratory
Gloria J. Wiener, River Studies Center, University of Wisconsin-La Crosse

Session Moderators

David Gross, Illinois Geological Survey
Al Van Vooren, Iowa Conservation Commission
Raymond Hubley, National Fishery Research Laboratory
Pam Thiel, Wisconsin Department of Natural Resources

Information Exchange

Leif Marking, National Fishery Research Laboratory

Assistance with Visual Aids

Patt Bailey
John Becker, University of Wisconsin-La Crosse
Mike Duval, University of Wisconsin-La Crosse
Paul Ritter, University of Wisconsin-La Crosse
Penny Schmidt, University of Wisconsin-La Crosse
Kate Sreenan, University of Wisconsin-La Crosse
Mark Steingraeber, University of Wisconsin-La Crosse
Jean Wright, University of Wisconsin-La Crosse

PROGRAM SCHEDULE

MISSISSIPPI RIVER RESEARCH CONSORTIUM

16th Meeting

La Crosse Radisson Hotel

Wednesday, April 18, 1984

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

Thursday, April 19, 1984

7:15 a.m. - 4:00 p.m.		Registration Desk Open (Main Lobby of Radisson)
		• • • CONTRIBUTED PAPERS • • •
		(Ballrooms A&B)
		Moderator: David Gross, Illinois Geological Survey
8:15 - 8:30 a.m.		Welcoming Remarks. K. S. Lubinski
8:30 - 8:50 a.m.	*(1)	Phytoplankton density and distribution in Pool 19, Mississippi River. J. A. Engman, R. V. Anderson, and L. M. O'Flaherty.
8:50 - 9:10 a.m.	(2)	Within and between pool variation in zooplankton density and diversity on the Upper Mississippi River. D. A. Pillard and R. V. Anderson.
9:10 - 9:30 a.m.	(3)	Methods of analysis and preliminary results of aquatic macrophyte production, Pool 19, Mississippi River. J. W. Grubaugh, R. V. Anderson, D. M. Day, B. S. Clark, D. J. Holm, and K. S. Lubinski.
9:30 - 9:50 a.m.	(4)	The influence of water depth on the biomass of the submergent macrophyte Vallisneria americana. G. N. Donnermeyer and M. M. Smart.
9:50 - 10:10 a.m.		Coffee Break
10:10 - 10:30 a.m.	(5)	An evaluation of changes in size and peak densities of dominant benthic organisms from lower reaches of Pool 19, Mississippi River. D. M. Day and R. V. Anderson.
10:30 - 10:50 a.m.	(6)	Effects of three commercial harvesting techniques on a mussel bed in Pool 19, Mississippi River. Richard E. Sparks and K. Douglas Blodgett.
10:50 - 11:10 a.m.	(7)	Naiad mollusks in the lower Wisconsin River, Wisconsin, a contrast with the Upper Mississippi River. M. E. Havlik.
11:10 - 11:30 a.m.	(8)	Effects of a short-term drought and subsequent low flows on fish activity in main channel border habitats of the lower Illinois River. S. D. Jackson and K. S. Lubinski.
11:30 - 12:00 noon		Business Meeting
12:00 - 1:20 p.m.		Lunch Break
		Moderator: Al Van Vooren, Iowa Conservation Commission
1:20 - 1:40 p.m.	(9)	River otter (Lutra canadensis) habitat utilization in northwestern Illinois. E. A. Anderson and A. Woolf.
1:40 - 2:00 p.m.	(10)	Active management of Mississippi River bottomland forests. R. D. Bollman and T. Feavel.

*Numbers correspond with those in the Abstracts.

2:00 - 2:20 p.m.	(11)	Impacts of the discharge of wastes from a large water treatment plant on the Mississippi River. Shun Dar Lin and R. L. Evans.
2:20 - 2:40 p.m.	(12)	An integrated biological and chemical approach to monitoring wastewater treatment plant effluents and their impacts on receiving water quality. D. K. Johnson.
2:40 - 3:00 p.m.		Break
3:00 - 3:20 p.m.	(13)	Circulation patterns of Montrose Flats. J. R. Adams and N. G. Bhowmik.
3:20 - 3:40 p.m.	(14)	Use of natural-gamma logging for characterization of bottom sediment in the Mississippi River. P. C. Reed, M. L. Sargent, and D. L. Gross.
3:40 - 4:00 p.m.	(15)	Preliminary study of island erosion, Pool 20, Mississippi River. J. D. Ives.
4:00 - 4:20 p.m.	(16)	Public information programs about the ecology and natural history of the Upper Mississippi River in a nonformal setting. D. W. McGuiness.

Thursday Evening

7:00 p.m.	The Upper Mississippi River: A Congressional Perspective. Congressman Steve Gunderson. (Ballrooms A&B)
8:00 -	Social Gathering at the Radisson (Ballrooms A&B). Special Program: Video tape of winter diving observations of Main Channel habitats and fishes, Pool 13. Presented by the Grafton Lab of the Illinois Natural History Survey.

Friday, April 20, 1984

8:00 - 12:00 noon		Registration Desk Open (Main Lobby of Radisson)
		• • • SPECIAL SESSION: ECOLOGY OF THE UPPER MISSISSIPPI RIVER • • • (Ballrooms A&B)
		Moderator: Raymond Hubley, National Fishery Research Laboratory
8:20 - 8:30 a.m.		M. M. Smart
8:30 - 9:00 a.m.	(17)	Hydrology, hydraulics and geomorphology of the Upper Mississippi River system. D. B. Simons, R. M. Li and Y. H. Chen.
9:00 - 9:20 a.m.	(18)	The hydrologic environment of Pool 19. N. G. Bhowmik and J. R. Adams.
9:20 - 9:50 a.m.	(19)	Microbial ecology of the Upper Mississippi River. M. R. Winfrey.
9:50 - 10:10 a.m.		Coffee Break
10:10 - 10:40 a.m.	(20)	Phycoperiphyton in selected reaches of the Upper Mississippi River: A comparison of community structure, diversity, and productivity. M. R. Luttenton, J. B. Vansteenburg, and R. G. Rada.
10:40 - 11:00 a.m.	(21)	The identification and ecology of periphytic diatoms of the Upper Upper Mississippi River (UUM) at Monticello, Minnesota. K. M. Knutson.
11:00 - 11:20 a.m.	(22)	Dynamics of the phytoplankton community in Navigation Pool No. 7 of the Upper Mississippi River. D. R. Huff.
11:20 - 11:50 a.m.	(23)	Ecology of the Upper Mississippi River: Wetland vegetation and aquatic macrophyte communities. J. H. Peck and M. M. Smart.
11:50 - 1:00 p.m.		Lunch Break

Moderator: Pam Thiel, Wisconsin Department of Natural Resources

1:00 - 1:20 p.m.	(24)	Aquatic macrophytes of the main channel border habitat of Pool 5A of the Upper Mississippi River. D. R. McConville, R. N. Vose, D. D. Anderson, and D. B. Wilcox.
1:20 - 1:40 p.m.	(25)	The historical, present, and likely future status of aquatic macrophytes of the Weaver Bottoms. R. N. Vose, D. R. McConville, and D. D. Anderson.
1:40 - 2:00 p.m.	(26)	The utilization of habitats associated with backwater area confluences by macroinvertebrates in the Upper Mississippi River. W. A. Sheaffer and J. G. Nickum.
2:00 - 2:30 p.m.	(27)	Macrobenthic distribution and community structure in the upper navigation pools of the Upper Mississippi River. C. A. Elstad.
2:30 - 3:00 p.m.	(28)	Predictive quality of macroinvertebrate habitat associations in lower navigation pools of the Upper Mississippi River. R. V. Anderson.
3:00 - 3:20 p.m.		Break
3:20 - 3:50 p.m.	(29)	Distribution of the ichthyoplankton of the Upper Mississippi River; An overview. L. E. Holland.
3:50 - 4:10 p.m.	(30)	The importance of habitats associated with backwater area confluences as nursery areas for the fishes of the Upper Mississippi River. W. A. Sheaffer and J. G. Nickum.
4:10 - 4:40 p.m.	(31)	The ecology of carp on the Upper Mississippi and Illinois Rivers. K. S. Lubinski, S. D. Jackson, J. Janecek, G. Farabee, and A. Van Vooren.
4:40 - 5:00 p.m.	(32)	Nesting success and feeding behavior of great blue herons on the Mississippi River near Cassville, Wisconsin and East Dubuque, Illinois. G. W. Kaufmann and E. T. Cawley.

As you ask questions please identify yourself and your institution, and then if the speakers would restate the questions before answering

I would like to thank the speakers for sharing their data with us and we look forward to seeing you again at the next meeting

AGENDA: BUSINESS MEETING

Mississippi River Research Consortium

11:30 a.m. - 12:00 noon, 19 April 1984

Ballrooms A&B, Radisson Hotel

Chairperson: Rosalie Schnick

1. Announcements
   a. The MRRC goals and history.
   b. Publication of the proceedings of Contaminants in the Upper Mississippi River.
   c. Updating the mailing list.
   d. Information exchange.
2. Financial status of the MRRC.
3. Annual Dues - mailings.
4. Publication of the proceedings of Ecology of the Upper Mississippi River.
5. Questionnaire results.
6. Students presenting papers.
7. Other business.
8. Nomination and election of Executive Committee.
9. Awards and acknowledgments.

CONSTITUTION
OF
THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

ARTICLE I. NAME AND OBJECT

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

2. The objectives of this organization shall be:

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

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

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

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

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

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

ARTICLE II. ORGANIZATION

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

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

ARTICLE III. MEMBERSHIP AND DUES

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

ARTICLE IV. AMENDMENTS

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

BY-LAWS
OF
THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

ARTICLE II. ORGANIZATION

Section I. Officers

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

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

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

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

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

Section II. Meetings

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

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

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

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

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

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

ARTICLE III. MEMBERSHIP AND DUES

Section I. Dues

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

Section II. Membership

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

ABSTRACTS FOR CONTRIBUTED PAPERS

Thursday, 19 April 1984

Abstracts are Listed in
Order of Presentation

(1) PHYTOPLANKTON DENSITY AND DISTRIBUTION IN POOL 19, MISSISSIPPI RIVER. J. A. Engman, R. V. Anderson, and L. M. O'Flaherty, Department of Biological Sciences, Western Illinois University, Macomb, Illinois 61455.

Phytoplankton production and density in riverine habitats are usually considered low. However, in large rivers, especially those where flow patterns have been altered by navigation structures, dense phytoplankton communities may develop. To assess changes in phytoplankton community composition, nine monthly Van Dorn samples from 34 sites, including five distinct habitat types were collected on Pool 19, Mississippi River. These samples were examined using diversity and community similarity indices. Diatoms were dominant in all months, with spring and fall maxima and lower densities in summer and winter. Cyclotella spp. were dominant in virtually all samples taken. Green and blue-green species reached maximum densities in summer samples. While in general community composition is similar down the length of the navigation pool, non-continuous backwater and vegetated sites developed distinctly different populations during the summer months. Vegetated sites were characterized by increased numbers of pennate diatoms (Cocconeis sp. and Navicula sp.). Isolated backwaters develop distinct populations dominated by species that occur only at low densities throughout the rest of the pool. During winter and spring, phytoplankton density increased from the Iowa to the Illinois shore along the entire length of the navigation pool.

(2) WITHIN AND BETWEEN POOL VARIATION IN ZOOPLANKTON DENSITY AND DIVERSITY ON THE UPPER MISSISSIPPI RIVER. D. A. Pillard and R. V. Anderson, Department of Biological Sciences, Western Illinois University, Macomb, Illinois 61455.

Relatively few zooplankton studies on the Upper Mississippi River are available. Those that have been completed are from widely separated pools providing the possibility of evaluating potential system wide changes in zooplankton density and diversity. Changes typically occur latitudinally as a result of distinct habitat changes from backwater or border plant beds to channel borders to channels. However, changes may also occur longitudinally due to shifts in particle size and quality of available food (CPOM to FPOM and UPOM or from detritus to phytoplankton). This shift is evaluated by examining zooplankton community composition first within a navigation pool, then between several pools. Only channel or channel border samples are compared to alleviate latitudinal effects. The dominant zooplankton throughout the UMR both within and between pools is Brachionus calyciflorus. However, diversity increased with downstream sample locations both within and between Pools, i.e. from 9 to 14 taxa in Pools 19 and 26 respectively. This central tendency was maintained through seasonal changes in taxa composition. Cladocera and Cyclops spp. becoming comparatively more abundant in summer. Density also increased with downstream sampling sites within and between pools. This shift in zooplankton community composition was correlated to changes in particle size of organic matter simultaneously collected with zooplankton.

(3) METHODS OF ANALYSIS AND PRELIMINARY RESULTS OF AQUATIC MACROPHYTE PRODUCTION, POOL 19, MISSISSIPPI RIVER. J. W. Grubaugh, R. V. Anderson, D. M. Day, B. S. Clark, D. J. Holm, and K. S. Lubinski, Aquatic Section, Illinois Natural History Survey, Havana and Grafton, Illinois, and Department of Biological Sciences, Western Illinois University, Macomb, Illinois.

Using a quadrat design, production of emergent, Sagittaria latifolia, and floating, Nelumbo lutea, aquatic macrophytes was determined in a plant bed on the Mississippi River near Nauvoo, Illinois. Twenty by 20 m quadrats were established prior to the 1983 growing season in areas of relatively homogenous stands of lotus and arrowhead and an unvegetated plot just outside the beds. All organic matter was removed from 20 $\frac{1}{4}m^2$ units within the quadrat monthly. Biomass of live, standing dead, and substrate organic matter was determined on 4 of these units. Repeat sampling on previously sampled units for regrowth and organic matter deposition escalated pyramidically with the length of the experiment. Maximum live biomass occurred during September in all plots. However, the greatest rate of growth, 4.87 g AFDW/day/m^2 for lotus and 9.69 g AFDW/day/m^2 for arrowhead, occurred between July and August samplings. In spite of the increase in live and standing dead biomass, little change in substrate organic matter occurred during the growing season. Organic matter did increase in substrates as the plants began to recede. However, based on substrate organic matter, much of the production and turnover in the macrophyte beds is exported to other river habitats.

(4) THE INFLUENCE OF WATER DEPTH ON THE BIOMASS OF THE SUBMERGENT MACROPHYTE VALLISNERIA AMERICANA. G. N. Donnermeyer, Department of Biology, College of St. Benedict/St. John's University and M. M. Smart, River Studies Center and Department of Biology, University of Wisconsin-La Crosse, La Crosse, WI 54601.

Vallisneria americana Michx. (wild celery) was studied in Navigation Pool No. 9 of the Upper Mississippi River during the summer and autumn of 1980 and the spring of 1981. One objective of this study was to examine the relation between water depth and rosette number, biomass and shoot:root ratios. Mean shoot:root (S:R ratios) increased from 1:3 in late May to the maximum of 8:7 in mid-July. Shoot:root ratios were positively correlated with water depth at the end of July ($r = .80$, $p < 0.05$). At this time, mean shoot biomass (leaves, peduncles, pistillate flowers, and fruit) were similar in deep (depth > 1 m) and shallow (depth $\leq$ 1 m) areas of the study area. Mean root biomass (stolons, root-stocks, winter buds) was higher (25.6 g/m^2) in shallow areas when compared with deep regions (14.5 g/m^2). Conversely, by 1 September, shoot biomass was greater in deep water (206.8 g/m^2) when compared to shallow water (149.3 g/m^2) and root biomass was similar in both. Rosette density increased from 80 rosettes/m^2 on 28 May 1980 to 214/m^2 on 1 September. The maximum correlation between rosette density and depth was observed on 1 September ($r = -0.74$, $p < 0.05$).

(5) AN EVALUATION OF CHANGES IN SIZE AND PEAK DENSITIES OF DOMINANT BENTHIC ORGANISMS FROM LOWER REACHES OF POOL 19, MISSISSIPPI RIVER. D. M. Day and R. V. Anderson, Department of Biological Sciences, Western Illinois University, Macomb, Illinois 61455.

Size frequency distribution and peak numerical and biomass density of fingernail clams and burrowing mayflies were determined during 1980 to 1983 from shallow channel border areas of lower reaches of Pool 19. Samples were collected using a Ponar dredge at 4 locations from Ft. Madison to Keokuk, Iowa. As well as comparing intrapool variation, data was compared to previous records of Hexagenia and Musculium from several of the sampled areas. Density varied significantly between sites, apparently a reflection of substrate type, proximity and degree of aquatic macrophyte development. Peak densities of both organisms were not found simultaneously. While the time sequence for the occurrence of maximum Hexagenia size and biomass does not vary from previous studies, that of Musculium does. In this study, maximum Musculium size was found in mid-fall, later than previously reported. Peak numerical densities for both organisms occur following reproduction, however, maximum biomass usually occurs during the late summer.

(6) EFFECTS OF THREE COMMERCIAL HARVESTING TECHNIQUES ON A MUSSEL BED IN POOL 19, MISSISSIPPI RIVER. Richard E. Sparks and K. Douglas Blodgett, Illinois Natural History Survey, River Research Laboratory, Box 599, Havana, IL 62644.

The effects of three commercial harvesting techniques on a mussel bed in the Mississippi River were quantitatively assessed by divers sampling within 1-square meter frames before and after the controlled harvest of test plots. The Illinois Department of Conservation considers all mussels greater than 6.35 cm in height to be commercial mussels. Mussel buyers have more restrictive criteria, purchasing only certain species and in all cases larger mussels.

If commercial shells are defined according to the buyers' criteria, a diver harvested 61% of the commercial shells present on the bottom, the basket dredge harvested 7% and the brail bar only 2%.

The dredge was the most destructive to the bed, dislodging 35.3 and damaging 13.8 live mussels for each commercial shell harvested. The brail bar dislodged 12.4 and damaged 0.0 live mussels per commercial shell harvested, and diving dislodged 0.1 and damaged 0.0. Recent decisions to restrict the dredge and to legalize diving in Illinois should decrease damage to mussel beds.

(7) NAIAD MULLUSKS IN THE LOWER WISCONSIN RIVER, WISCONSIN, A CONTRAST WITH THE UPPER MISSISSIPPI RIVER. Marian E. Havlik, Malacological Consultants, 1603 Mississippi Street, La Crosse, Wisconsin 54601.

Since 1979 the diversity of naiad mollusks at a number of sites in the Lower Wisconsin River downstream of the Prairie du Sac, WI, dam has been determined by wading and SCUBA diving. A total of thirty live species have been found in the Lower Wisconsin by contemporary researchers. One new species was added to that number among the 24 live and 2 dead species found during this study, the extremely rare Simpsonaias ambigua which has Necturus maculosus as its host. Although Baker (1928) had reported dead S. ambigua in the Wisconsin Dells (Kilbourn) area, this species had never been found alive in the Wisconsin River until 1981, and it is only the second live Wisconsin record of this species since the 1930's. An empty, eroded shell, thought to be Lampsilis higginsi, was found near Port Andrews, WI. At one site Tritogonia verrucosa was the most common species; 60 of these specimens were experimentally transplanted into Wigwam Slough, a Mississippi River backwater adjacent to Goose Island just downstream of La Crosse, WI. Some species (T. verrucosa, Quadrula metanevra, Plethobasus cyphyus, Pleurobema sintoxia, and Lasmigona compressa) seldom found alive in the Upper Mississippi River, were found in sand-gravel-cobble substrate. Conversely, a common Upper Mississippi River species, Amblema p. plicata, was seldom found. Several common Upper Mississippi River species were represented by unusually large specimens from the Lower Wisconsin. Some seemingly suitable substrates in the Wisconsin River are nearly devoid of naiades near Woodman, WI. The Lower Wisconsin River environment remains suitable for several naiad species that are seldom found alive in the Upper Mississippi River emphasizing the need for preserving the remaining unique habitats in the Wisconsin River.

(8) EFFECTS OF A SHORT-TERM DROUGHT AND SUBSEQUENT LOW FLOWS ON FISH ACTIVITY IN MAIN CHANNEL BORDER HABITATS OF THE LOWER ILLINOIS RIVER. S. D. Jackson and K. S. Lubinski, Illinois Natural History Survey, Pool 26 River Research Lab, R. R. 1, Box 221, Grafton, IL 62037.

Hoopnets were used to monitor fish activity in main channel border habitats of the lower Illinois River between 15 June and 3 November, 1983. Species composition in the catch changed drastically at the onset of an unusual low flow period. Freshwater drum was the predominant species collected before 20 July when normal flow conditions prevailed, while black crappies and other centrarchids comprised most of the catch during the following three month period. Total catch (lbs/net-day) of all species did not appear to be affected by the low flow, but a comparison of day vs. night collection results indicated that more and smaller fish were day-active while fewer but larger fish were active at night. Total catch peaks, particularly during the low flow period, closely followed days when backwater temperatures were several degrees (C) higher than those in the main channel border. We concluded that during periods of low flow, lower Illinois River main channel borders provide suitable, if not preferred, habitat for species that are usually associated with backwaters. From a broader perspective, these results illustrate that functional roles of floodplain river habitats can be flow dependent even near the low end of the flow sprectrum.

(9) RIVER OTTER (LUTRA CANADENSIS) HABITAT UTILIZATION IN NORTHWESTERN ILLINOIS. E. A. Anderson and A. Woolf, Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL 62901.

A study was conducted from August 1982 through December 1983 to identify and characterize critical areas of river otter habitat along and nearby the Mississippi River in northwestern Illinois, to determine seasonal utilization of an example of such habitat, and to assess potential impacts of the various resource uses on the otter population in these areas. Two male otters were livetrapped, each surgically implanted with a radio transmitter, and released. Monitoring of habitat and den selection by these otters through radio telemetry and that of other otters, including a small family group, through field observations identified the type of areas used by otters and seasonal utilization of those areas. Characteristics of suitable habitat included: (1) isolation from the main channel; (2) riparian habitats of extensive woodlands; (3) good water quality; (4) areas of open water in winter; and (5) presence of suitable den sites. Evaluation of habitats along that portion of the Mississippi River bordering Illinois resulted in identification of 13 areas of critical river otter habitat. During spring and fall, food and Mississippi River stage appeared to exert the greatest influence on habitat selection. In winter, the presence of areas of open water determined habitat use. Of all the resource uses, barge traffic and furbearer trapping appeared to have the greatest potential impact on the otter population. In addition, high water levels during March and April may adversely impact otter reproduction and therefore be a potential limiting factor to the population. Analysis of 765 otters scats, indicated fish were the principal otter prey with Centrarchidae, Cyprinidae, and Clupeidae occurring in 49, 41, and 36% of the scats, respectively.

(10) ACTIVE MANAGEMENT OF MISSISSIPPI RIVER BOTTOMLAND FORESTS. R. D. Bollman, T. Feavel, U.S. Army Corps of Engineers, Rock Island District, Miss. River Proj., Pleasant Valley, IA 52767.

In 1963 a cooperative agreement was entered into between the Corps and the U.S. Fish and Wildlife Service that called for cooperative management of approximately 84,000 acres of wetland and forest, belonging to the Corps within the Rock Island District. Outgranted to the Service for fish and wildlife management purposes it was often subgranted to state agencies for similar management. Despite the outgranting of these lands to other agencies, the Corps retained basic ownership of the land, with timber harvesting rights unimpaired. Corps' Forest, Fish and Wildlife Appendix was officially approved for implementation in April 1982. The plan is an appendix to the existing 1969 revision to the Corps Master Plan within the Rock Island District. Primary objective of the plan is to enhance the overall health and productivity of floodplain forests on Corps lands, thereby increasing the value of such lands for beneficial uses involving conservation, fish and wildlife habitat, and recreation. Through implementation of forest prescriptions involving harvesting, timberstand improvement, thinning, and planting, a diversity in tree age and size class is maintained in a unit. A balance in acreage of old growth, mature, pole size, and saplings or seedling trees is the objective. The Corps is utilizing a go-slow philosophy and is subsequently backing up physical implementation with monitoring studies to determine long term effects. The monitoring systems include: tree regeneration studies, deer utilization studies, avian utilization studies, and tree seed production studies. Much of the data to be accumulated will serve to support accepted biological and ecological principles that all active natural systems management is based upon; i.e. those involving species diversity, population density, plant succession, etc.

(11) IMPACTS OF THE DISCHARGE OF WASTES FROM A LARGE WATER TREATMENT PLANT ON THE MISSISSIPPI RIVER. Shun Dar Lin, and Ralph L. Evans, Water Quality Section, Illinois State Water Survey, Box 697, Peoria, IL 61652.

In Illinois some sort of treatment is required for waste discharges to the receiving water from a water treatment plant. This study was to assess the effect, if any, of the waste discharge from the water treatment plant at East St. Louis, Illinois, on the bottom sediments of the Mississippi River.

Thirty-five river bottom samples were collected twice in the vicinity of the waste outfall. For each sample, analyses were performed for iron and aluminum concentrations, percent moisture, volatile content, and particle size distribution.

The impact of the wastes on the river sediments could not be detected on November 12, 1981 a week after cleaning of basins 1 and 2. During the waste discharge from basin 4, on August 12, 1983, the impact as measured by physical and chemical characteristics was limited to three stations and was confined to about 100 ft. offshore and 4,000 feet downstream of the outfall. Within the zone of influence iron and aluminum concentrations increased about 3.4-fold and 8-fold above the estimated background concentrations. The percentages of moisture and volatile of the sediments also increased.

At normal river flows, the collected sediments (11/12/1983) consisted of 92% of sand, 8% gravel, and no silt and clay. Silt and clay (34.5%) were found at two somewhat protected stations at low flow stage during waste discharge period. This was the result of the reintroduction of river silt and clay to the river by waste discharge containing material captured during the treatment process.

It was concluded that the infuence of the waste discharge on the bottom sediment was not one of significant degradation. This does not suggest that wastes from some water treatment plants will not adversely affect the waters of a receiving stream. In general the relationship of waste discharge to water quality must be considered on a case by case basis.

(12) AN INTEGRATED BIOLOGICAL AND CHEMICAL APPROACH TO MONITORING WASTEWATER TREATMENT PLANT EFFLUENTS AND THEIR IMPACTS ON RECEIVING WATER QUALITY. D. K. Johnson, Quality Control Dept., Metropolitan Waste Control Commission, St. Paul, MN 55101.

In the Minneapolis-St. Paul area, the MWCC operates 14 wastewater treatment plants which discharge to 4 major rivers.

Since 1979, the MWCC has developed and implemented a toxicity-testing program for monitoring potential impacts of treatment plant effluents on aquatic riverine fauna. The approach is basically two-fold. On an annual basis, all 14 treatment plants are subjected to 24-hr. static screening tests with Daphnia, Hexagenia, and bluegills, including chemical analysis of each effluent. Based on screening test results, 5 treatment plants each summer are selected for more definitive toxicity evaluations. Each evaluation is conducted on-site in a mobile laboratory, and consists of 96-hr. flow-through testing with bluegills, 48-hr. static testing with Daphnia, and comprehensive chemical analysis of the effluent.

To date, definitive tests have been conducted at the 4 largest MWCC plants, and toxicity-testing has proven to be a valuable tool for evaluating effluent quality. Biological response in these site- and time-specific studies has ranged from no toxicity to measurable toxicity, while chemical analyses have identified un-ionized ammonia, certain metals, and cyanide as potential toxic agents. The effectiveness of nitrification and tertiary treatment for ammonia removal has been intially investigated, and a dechlorination procedure has also been evaluated. Study results have confirmed the usefulness of a multi-species, rather than single species, approach for evaluating effluent toxicity.

In order to determine potential effluent impacts on receiving water quality, results of effluent toxicity-testing have been integrated with ongoing MWCC chemical and biological monitoring programs for area rivers. Chronic instream toxicity studies with Daphnia and Hexagenia are also being planned.

Overall, MWCC's biological and chemical approach to effluent and river monitoring closely parallels that recommended recently (August, 1983) by EPA for establishment of water quality-based permit limitations for toxic pollutants.

(13) CIRCULATION PATTERNS ON MONTROSE FLATS. J. Rodger Adams and Nani G. Bhowmik, Surface Water Section, Illinois State Water Survey, Champaign, IL 61820.

In conjunction with intensive biological sampling, we measured circulation data on Montrose Flats at mile 375, Upper Mississippi River, in October 1982 and May 1983. Vanes suspended below surface floats were tracked to determine the direction and speed of water currents near the biological sampling sites. The circulation pattern in October 1982 was a large elliptical eddy in the broad, shallow channel border area. In May 1983, water flowed over the flats in the downstream direction. The different circulation patterns are related to the flow rate in the river. The fate of the sediment and other suspended material which enters the Mississippi River at the upstream end of Montrose Flats is discussed for the observed flow patterns.

(14) USE OF NATURAL-GAMMA LOGGING FOR CHARACTERIZATION OF BOTTOM SEDIMENT IN THE MISSISSIPPI RIVER. P. C. Reed, M. L. Sargent, and D. L. Gross, Illinois State Geological Survey, 615 East Peabody Drive, Champaign, IL 61820.

As part of a Long-Term Ecological Study of the Mississippi and Illinois Rivers, the first year geological activities included sediment mapping in Pool 19 (Keokuk) of the Mississippi River. Sediment grab samples and cores were collected from 312 locations in the pool; however, since the horizontal distances between sampling points are substantial, questions still remain as to local variations in grain size of sediment.

Utilizing the standard borehole equipment, with a change in methodology, five east-west traverses were logged in Pool 19 to obtain continuous representations of bottom sediment. A gamma-ray sonde connected to the logging truck parked on shore was towed by boat to the middle or far side of the river, dropped to the bottom and winched horizontally back to the truck, where natural-gamma radiation was recorded continuously. A marker buoy attached to the sonde provided a reference point for collection of grab samples of bottom sediment, typically 5 to 25 samples per traverse. Counts per second of natural-gamma radiation in the river showed a high positive correlation with laboratory measurements of percentage of clay-size bottom sediment. Naturally occurring gamma-emitting radioisotopes include potassium-40 and daughter products of the uranium and thorium-decay series concentration in the clay minerals.

Field descriptions of samples from the 312 locations indicated that sediment in the main channel of Pool 19 is coarse throughout--sediment on either side of the navigation channel ranges from clean, coarse sand upstream to silt and clay downstream. The natural-gamma radiation work demonstrated that natural-gamma ray borehole logging technique is applicable to continuously measuring grain size of sediment in a major river; that sediment grain size is uniform in the main channel and in large areas away from the main channel; and that significant local variations in grain size may exist on the edges of the main channel with a cycle of 5 meters in the measured direction.

(15) PRELIMINARY STUDY OF ISLAND EROSION, POOL 20, MISSISSIPPI RIVER. J. D. Ives, Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

The instability of river islands has long been recognized. The formation of new islands has often been intriguing to many biologists because of the availability of new land available for colonization. The loss of old islands is also a phenomenon of great concern. Not only is the river system forced to carry the additional sediment load but sometimes vital habitat is lost. Mud Island, located in the upper portion of pool 20 is such a critical habitat. The island lays adjacent to the large Cedar Glen bald eagle winter night roost. The trees on the upper end of the island are documented as having extensive eagle use during severe winter weather. As part of a study of the eagle use trees it was noted that island head-end erosion had caused the loss of some trees and threatened others. A simple system of triangulation was established to document the rate and amount of island loss. Over one winter-spring season as much as 2 meters were lost due to erosion. During this time period there were 3 periods of very high water. It appears that severe erosion occurs only when the river level reaches critical levels and that the rate of erosion is not uniform around the island head.

(16) PUBLIC INFORMATION PROGRAMS ABOUT THE ECOLOGY AND NATURAL HISTORY OF THE UPPER MISSISSIPPI RIVER IN A NONFORMAL SETTING. D. W. McGuiness, Department of Continuing Education, Science Museum of Minnesota, St. Paul, MN 55101.

During the last decade extensive efforts have been undertaken to provide current research information, study findings, and agency decisions to the general public under the auspices of the GREAT studies and the Master Plan studies. Since the culmination of these studies various efforts have been made to continue to provide the general public with information about river ecology, natural history, and to keep the public abreast of current decisions being made about the Mississippi River.

Three current nonformal efforts to provide information to the public and to advise them of current decisions being made about the resource include the following nonprofit corporations or organizations: The Mississippi River Revival, River Country Voices, and The Science Museum of Minnesota. Each entity reaches its own segment of the public, with some overlap in "membership".

Two of the three organizations provide principally an educational function while the third serves as a grassroots effort to affect the decison-making process through citizen participation and local organizing.

A comparison of the objectives and programs of each of these organizations indicates there are some differences and similarities among them. The effectiveness of each organization at achieving its own goals is different in each case, with each contributing, in some way to overall ongoing public understanding of the resource and decisions being made about it.

ABSTRACTS FOR SPECIAL SESSION

"ECOLOGY OF THE UPPER MISSISSIPPI RIVER"

Friday, 20 April 1984

Abstracts are Listed in

Order of Presentation

Proceedings of this Symposium will be published in "Hydrobiologia" and in book form in the series "Developments in Hydrobiology" by Dr. W. Junk Publishers, The Hauge, Netherlands, after peer review.

(17) HYDROLOGY, HYDRAULICS AND GEOMORPHOLOGY OF THE UPPER MISSISSIPPI RIVER SYSTEM. D. B. Simons, R. M. Li and Y. H. Chen, Simons, Li & Associates, Inc., Fort Collins, Colorado.

The upper Mississippi River has been modified with locks, dams, dikes, bank revetments, channel modifications and dredging to provide a nine-foot navigation channel. These activities have changed the river's characteristics. The historical changes in the hydrologic, hydraulic and geomorphic characteristics were assessed and related to navigation development and maintenance activities in the upper Mississippi river system. The hydrologic, hydraulic and geomorphic features studied include river discharges, stages, sediment transport, river position, river surface area, island surface area, and river bed elevation. In addition, water and sediment transport effects on dredging were estimated. It was found that the position of the upper Mississippi River remained essentially unchanged in the last 150 years except for specific man-made modifications. The hydrology of the upper Mississippi has been affected by developments in the river basin. The stage, velocity, sediment transport and river and island areas were significantly altered by development of the nine-foot navigation system, mainly at low and intermediate flows. At high flow, the stage, velocity and sediment transport in the post-lock and dam condition are similar to the pre-lock and dam condition. The backwater areas are experiencing some deposition. With implementation of erosion control measures major tributaries and upland areas, better confinement of disposed dredged materials and better maintenance practices, the sedimentation and pertinent problems in the main channel as well as in the backwater areas may be reduced with time.

(18) THE HYDROLOGIC ENVIRONMENT OF POOL 19. Nani G. Bhowmik and J. Rodger Adams, Surface Water Section, Illinois State Water Survey, Champaign, IL 61820.

The water and suspended sediment inflows, transport, change in volume, and outflows determine the environment for aquatic plants and animals. The available data for Pool 19 between Keokuk, Iowa and Gladstone, Illinois are used to illustrate the various ways of presentation and interpretation. The long-term water discharge record at Keokuk is used to demonstrate various types of averages and measures of variability. Flow duration curves are also explained. Suspended sediment concentration data are available for about 12 years at Keokuk and Burlington. The impact of tributary inflows is discussed using water and sediment data for the Skunk River and Henderson Creek. The annual cycle of water and sediment fluxes is also described for low, average, and high flow years.

(19) MICROBIAL ECOLOGY OF THE UPPER MISSISSIPPI RIVER. M. R. Winfrey, River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601.

Microbial activities are an important, yet often overlooked, aspect of the ecology of the Upper Mississippi River. Much of the microbiological research in the Mississippi River has emphasized the detection and quantification of pathogenic microorganisms. Although such studies are of obvious public health significance, they afford little insight into the ecology of autochthonous bacteria in such systems. The native aquatic bacteria in riverine systems have evolved a variety of adaptations to their environment such as unusual cellular appendages, a variety of tactic responses, and mechanisms of attachment to surfaces. Such adaptations enable bacteria to localize in microniches optimal for their survival and result in large variations in microbial activities in environments spatially separated by short distances. Such microorganisms are primary agents in the cycling of organic matter, sulfur, and nitrogen in riverine environments. Microbial activities are also directly involved in the transformation and mobilization of a variety of organic and inorganic aquatic contaminants. In light of the importance, yet lack of knowledge, of microbial activities in the Upper Mississippi River, the microbial ecology of this important resource surely deserves further study.

(20) PHYCOPERIPHYTON IN SELECTED REACHES OF THE UPPER MISSISSIPPI RIVER: A COMPARISON OF COMMUNITY STRUCTURE, DIVERSITY, AND PRODUCTIVITY. M. R. Luttenton, J. B. Vansteenburg, and R. G. Rada. University of Oklahoma, Norman, OK 70319, University of Iowa Hygienic Laboratory, Iowa City, IA 52242, and River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601.

Phycoperiphyton communities along the border of the main channel in Pools 5 and 9 and backwaters in Pool 8 were studied using glass substrates. Natural substrates were also analyzed in Pool 5. Accrual of chlorophyll a during the 28-day exposure periods ranged from <5 mg/m^2 to ~15 mg/m^2. Maximal accural was greater in Pool 9 than in Pool 5. Cell densities varied substantially among sampling dates and stations and ranged from ca $1x10^9$ to $1x10^{10}$ cells/m^2 in Pool 5 and from $1x10^8$ to $3x10^9$ in Pool 9. Diatoms were the most common group of algae (324 taxa) and accounted for the majority of total cell density except during July when green algae were the most important group in Pool 5. A similar peak in green algal density was not observed in Pool 9; however, blue-green algae were common in June. Two distinct diatom assemblages were observed along the border of the main channel in Pool 5, an early spring-late fall assemblage and a summer assemblage (July through October). The spring-fall assemblage was relatively diverse and included many common taxa that grow weakly attached to the substrate and develop a three-dimensional community structure. In contrast, summer assemblages were less diverse and dominated by one or two strongly adenate taxa that gave the community a two-dimensional structure. Similar communities were observed in Pool 9 although dominant species occasionally differed between the two pools. Summer community structure may have resulted from constant inhibitation of secondary community development by turbulence that favored adenate taxa. These results suggest that the main channel of the Upper Mississippi River supports a productive attached algal community that has a greater diversity and lower density in the early spring and late fall than in the summer. Preliminary results indicate that community structure was similar between natural and artificial substrates in Pool 5 and that diversity and density were at least as great in backwater areas of Pool 8 as in main channel areas of Pools 5 and 9.

(21) THE IDENTIFICATION AND ECOLOGY OF PERIPHYTIC DIATOMS OF THE UPPER UPPER MISSISSIPPI RIVER (UUM) AT MONTICELLO, MINNESOTA. K. M. Knutson, Department of Biological Sciences, St. Cloud State University, St. Cloud, MN 56301.

The Upper Upper Mississippi River (UUM) at Monticello, MN (mile 25.5, 41 km) was the site for the study of the identification and ecology of colonizing diatoms. The UUM begins at Anoka, MN and is 476 miles (765.9 km) from its Lake Itasca source. At Monticello the Mississippi is characterized as a shallow (mean depth 1.9m), active erosional type river with numerous riffles and pools. The sample location was 300m wide, of fast current velocity (to 1.8 m/sec) and small discharge (average 130 m^3/sec). The diatom community collected from natural habitats and artificial substrates (glass microscope slides) showed no significant species difference. Annual quantitative dominance typically showed Cocconeis placentula with var lineata and var euglypta, Diatoma vulgare, Gomphonema olivacium, G. parvulum, Navicula salinarum var intermedia, and N. gracilis in descending dominance order. The seasonal distribution was characterized by mesothermal Cocconeis varieties during summer months and the remaining oligothermal dominants with spring and fall optimum growth. Peak biweekly chlorophyll biomass production of the oligothermal community on glass slides was 7.2 µg Chl "a"/cm^2 in spring and 10.5 µg Chl "a"/cm^2 in fall when water temperatures ranged 3-13 C. The summer mixed mesothermal forms were less productive, .5-5 µg Chl "a"/cm^2 in 14-25 C river water. This eight year study (1968 to 1976) provides a comprehensive description and ecology of the 140 periphytic diatom species community of the UUM.

(22) DYNAMICS OF THE PHYTOPLANKTON COMMUNITY IN NAVIGATION POOL NO. 7 OF THE UPPER MISSISSIPPI RIVER. Donald R. Huff, University of Wisconsin-La Crosse, La Crosse, WI 54601.

A study of the phytoplankton community dynamics was conducted on Navigation Pool No. 7 of the Upper Mississippi River from May through October 1982. The objectives of this study were to estimate total standing crops, determine the taxonomic composition and examine the seasonal succession of the phytoplankton community. Four sampling sites were established: two in Lake Onalaska, a large backwater lake on the Wisconsin side of the main channel; one in the main channel near Dakota, Minnesota; and one in the main channel just upstream from Lock and Dam No. 7.

The phytoplankton communities at all sampling sites were dominated by diatoms except during July and August when a bloom of blue-green algae was observed. The dominant diatoms from May through mid-July were Melosira italica, Melosira varians, Stephanodiscus niagarae, Stephanodiscus hantzschii, Stephanodiscus astrea, and Synedra ulna. Aphanizomenon flos-aquae and Microcystis aeruginosa were the most prevalent blue-green algae during the mid-summer bloom. The diatoms Melosira italica and Melosira granulata were dominant in September and October. Lesser amounts of green algae, cryptomonads and euglenoids were also observed at various times of the sampling period.

Total standing crops based on cell volume were usually greatest at the Lock and Dam No. 7 site. The maximum standing crop (10.4 mm^3/L) was observed at the Lock and Dam No. 7 site on 4 September; the minimum standing crop (0.4 mm^3/L) was observed at the eastern Lake Onalaska site on the same date. Concentrations of nitrogen, phosphorus, and silica remained at high levels throughout the study period and did not appear to limit phytoplankton standing crops.

(23) ECOLOGY OF THE UPPER MISSISSIPPI RIVER: WETLAND VEGETATION AND AQUATIC MACROPHYTE COMMUNITIES. J. H. Peck, Department of Biology, University of Arkansas-Little Rock, Little Rock, AR 72204 and M. M. Smart, River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601.

The five states which border the Upper Mississippi River (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) have strong botanical traditions which document the identity, taxonomy, floristics, or ecology of their wetland vegetation and aquatic macrophytes on the Mississippi River and its floodplain. An analysis is provided on the chronological development of that literature. A critique of the present resources and future needs of taxonomic and floristic literature is presented to direct future studies and to qualify existing data. An evaluation of the ecological reports is presented which relates the character of the data base to management of wetland and aquatic vegetation in and along the Mississippi River. Difficulties in classification of communities are noted as a natural outcome of the magnitude of perturbation and management on vegetation dynamics. A critique of our vegetation view is presented to direct future efforts.

(24) AQUATIC MACROPHYTES OF THE MAIN CHANNEL BORDER HABITAT OF POOL 5A OF THE UPPER MISSISSIPPI RIVER. D. R. McConville and R. N. Vose, Department of Biology, Saint Mary's College, Winona, MN 55987 and D. D. Anderson and D. B. Wilcox, Saint Paul District, U.S. Corps of Engineers, St. Paul, MN 55101.

Main channel border habitat aquatic macrophytes are a small, inconspicuous and stable component of the Pool 5A river ecosystem. Aquatic plant surveys in 1980 and 1983 yielded similar results. Ninety-seven plant clusters were located in 1980. Ninety-eight were found in 1983. The 1983 survey located 82.5% of the clusters described in 1980. The 1983 survey located 16 clusters which were not located in 1980. Chi-square analysis of the 1980 and 1983 data indicated that 1980 and 1983 results were statistically the same. The only exception was sago pondweed which decreased in abundance from 1980 to 1983. The average plant cluster size for both surveys was 0.13 to 0.15 hectares. The smallest plant cluster was less than 0.01 h and the largest was approximately 2.25 h. In 1983, 50.7% of the plant assemblages were less than 0.01 h and only 2.6% were greater than one h. The rock survey located eight species in both years. The four most prominent species were wild celery, water stargrass, sago pondweed and river pondweed. During both years, the rock structure macrophytes were robust and healthy. The 1980 edge survey located nine submergent and seven emergent species. The 1983 survey located ten submergents and nine emergents. During both years the most common submergents were wild celery, water stargrass, sago pondweed and coontail. The distribution of the submergents was statistically equal between the MN and WI sides of the channel. Wild celery and water stargrass were statistically equal in the lower two thirds of the pool but less abundant in the upper pool third. Of the four major species, sago pondweed was the most tolerant of shallow depths ($\bar{X}$ = 0.33 m) and the least tolerant of silt bottom habitats. Coontail preferred the deepest water ($\bar{X}$ = 0.41 m) and was the most tolerant of variable substrates. The most frequently observed emergent during both years was broad-leaf arrowhead.

(25) THE HISTORICAL, PRESENT, AND LIKELY FUTURE STATUS OF AQUATIC MACROPHYTES OF THE WEAVER BOTTOMS. R. N. Vose and D. R. McConville, Department of Biology, Saint Mary's College, Winona, MN 55987, and D. D. Anderson, Saint Paul District, Army Corps of Engineers, St. Paul, MN 55101.

There is considerable interdependence between the plant life of any area, other biota, and the physical forces at work there. Thus, observing a riverine marsh's macrophytic community is probably the quickest way to reasonably estimate that marsh's ecological status. Current macrophytes are easily described. Additionally, the extent and sometimes even the composition of historical communities can be determined from old aerial photographs, providing a glimpse of past ecological conditions.

Photographs taken in 1929, 1938, 1951, 1965 and 1971 of Weaver Bottoms, a 5000-acre backwater, were examined. Recent status was determined by extensive field work in 1975, 1977 and 1983. Prior to Lock & Dam 5 completion, the area was mainly floodplain forest and meadow. The filling of Pool 5 turned Weaver Bottoms into an extensive marsh. Between 1938 and 1951 emergent macrophytes declined from 3000 to 2600 acres, and then stabilized. By 1971 they had decreased by over 40%, and the decline is continuing. The quality and success of hunting and sport and commercial fishing, once outstanding, have also declined, paralleling the vegetative reductions. The decrease in plants appears related to dredging associated with channel maintenance and to wave activity. Recent work shows macrophytes concentrated in low-flow border areas. Emergents are dominated by arrowheads and lotus, the latter fluctuating widely in the recent years. Submerged species are dominated by coontail and wild celery. Submergents have changed little in total, but species composition changes have been dramatic. Recent changes may foretell of the coming death of Weaver Bottoms as a productive marsh area.

(26) THE UTILIZATION OF HABITATS ASSOCIATED WITH BACKWATER AREA CONFLUENCES BY MACROINVERTEBRATES IN THE UPPER MISSISSIPPI RIVER. William A. Sheaffer and Dr. John G. Nickum, Iowa Cooperative Fishery Research Unit, Iowa State University, Ames, IA 50011.

It is possible that there is passive transport of aquatic organisms and nutrients between backwater areas and the main channel of the Upper Mississippi River. This drift could result in productive downstream areas that may support more macroinvertebrates which would make them important feeding grounds for the fishes present. It is necessary that these areas be investigated before the backwater areas are lost due to sedimentation.

Three backwater areas were sampled in Navigational Pool 13 of the Upper Mississippi River from 2 April 1983 to 19 August 1983. Weekly surface and bottom tows were conducted at night in the main channel upstream and downstream from the confluences of the backwater areas and in the backwaters near their confluences. Three replicates were taken at each site. Samples were sorted and macroinvertebrates identified.

The data will be analyzed to examine differences between surface and bottom samples and between the three habitat types. This will show if there is transport from the backwaters to the main channel and if areas downstream of the backwater confluences are more productive.

(27) MACROBENTHIC DISTRIBUTION AND COMMUNITY STRUCTURE IN THE UPPER NAVIGATION POOLS OF THE UPPER MISSISSIPPI RIVER. Catherine A. Elstad, Department of Zoology, Washington State University, Pullman, WA 99164.

The northern section of the Upper Mississippi River supports a diverse macrobenthic assemblage. The distribution of this benthic fauna, benthic community structure, and factors which influence both of these phenomena in these upper pools are discussed. The dumping of heavy loads of municipal and industrial wastes from the Minneapolis-St. Paul metropolitan area has severely stressed the benthic community. The once abundant, pollution-sensitive mayflies, Hexagenia bilineata and H. limbata, are noticeably absent, replaced by pollution-tolerant oligochaetes and the midge Chironomus. The harmful effects of this pollution are not restricted to the area immediately downstream from the Twin Cities. In Lake Pepin, the Hexagenia population has suffered a drastic decline. The benthic community is characterized by low species diversity and a dominant, pollution-tolerant Chironomus plumosus - Oligochaeta - Sphaeriidae - Hirudinea community complex. Farther south the effects of the high organic load which originates approximately 226 km upstream are ameliorated. The inundation of large, diverse land areas contributes to the great ecological diversity in Pools No. 7 and No. 8. In Navigation Pool No. 7, benthic standing crops in the backwater pool areas (Biomass range: 2.075-26.955 gm^{-2}) exceed those in the main channel (biomass range: 0.049-1.019 g m^{-2}). Greater numbers of burrowing mayflies and mollusks were found in the pool areas. Of the 131 taxa collected from 1976-1977 in Lake Onalaska, which occupies most of Pool No. 7, eight dominant groups--Oligochaeta, Hirudinea, Isopoda, Amphipoda, Lepidoptera, Diptera, Gastropoda, and Pelecypoda--accounted for 90-93% of the macroinvertebrates. In Pool No. 8, over half of the 144 benthic taxa collected during the summer of 1975 were insect nymphs and larvae. Oligochaetes were by far the most ubiquitous and dominant macroinvertebrates. Greatest oligochaete densities ranged from approximately 10,302 individuals m^{-2} to 17,306 individuals m^{-2}. Habitat preferences of particular benthic forms were reflected in the distributional relationships between the macroinvertebrates and the physical-chemical conditions. Benthic production, in terms of the total wet weight m^{-2} and the mean number of macroinvertebrates m^{-2} in each study area, was generally greater in the more eutrophic areas. The more eutrophic areas supported fewer taxa. These taxa generally consisted of pollution-tolerant organisms, such as oligochaetes and certain chironomids, which were capable of burrowing into the depositional-type substrates. More taxa and greater numbers of gill breathers and filter feeders, such as caddisflies, mayflies, stoneflies, and dipterans, were collected from the less eutrophic areas.

(28) PREDICTIVE QUALITY OF MACROINVERTEBRATE HABITAT ASSOCIATIONS IN LOWER NAVIGATION POOLS OF THE UPPER MISSISSIPPI RIVER. R. V. Anderson, Department of Biological Sciences, Western Illinois University, Macomb, Illinois 61455.

Macroinvertebrate studies in the Upper Mississippi River have increased over the past several years under the auspices of state and federal commissions or agencies. These studies, often directed at a specific location or question, provide an underutilized resource if predictive generalizations can be made from the data. This paper first reports on intensive studies of macroinvertebrate community structure in relation to specific habitat types in Pools 19 and 26 and then examines the predictive value of the data. Using community similarity indices with systematic sampling within pool, the analyses defined 5 distinct macroinvertebrate community types. The defined habitats with specific macroinvertebrate communites, include emergent and floating vegetation, submerged vegetation (both, either in backwaters or shallow channel borders), unvegetated channel border areas, tailwaters or rock substrates and channel. Species composition, density, diversity, and dominance of macroinvertebrates significantly changed from littoral to epi-endobenthic to epibenthic to a community with a depauperate fauna. Specific community boundaries could be defined with greater between-habitat than within-habitat variability of macroinvertebrates. The preceding community analyses were evaluated for their predictive capability by comparing the data to studies reported in the literature and random samples in several habitats of Pools 19 through 26. The consistency of macroinvertebrate-habitat associations was projected to Pool-wide or system-wide predictions of population and biomass and thus invertebrate resource availability. Also, the possibility of using invertebrate to monitor system successional changes and stablity was suggested by the comparative analysis.

(29) DISTRIBUTION OF THE ICHTHYOPLANKTON OF THE UPPER MISSISSIPPI RIVER: AN OVERVIEW. Leslie E. Holland, National Fishery Research Laboratory, U.S. Fish and Wildlife Service, La Crosse, WI 54601.

A small number of the over 130 known species in the adult ichthyofauna of the pooled portions of the Mississippi River have been observed in the ichthyoplankton. Consequently, information on the early life histories of many of our important species is limited. This lack of significant data results primarily from a limited number of studies, but also from a combination of restricted study designs coupled with inadequate sampling for species with different reproductive strategies. The majority of species collected represent pelagophilic or litho-pelagophilic strategies; those species with semibuoyant eggs and larvae (e.g. freshwater drum, emerald shiners) or adhesive eggs but buoyant larvae (e.g. gizzard shad). The drums, shads, and minnows constitute nearly 90% of the total catch in most studies. Observed habitat-specific species assemblages also reflect the reproductive strategies of fishes in the pools. The main channel assemblage is comprised of freshwater drum, gizzard shad, emerald shiners, and specific stages of crappies, white bass, and carp; the guarders (sunfishes, bass) and those species whose larvae have adhesive organs (northern pike, brook silversides) characterize the backwater assemblage. Temporal and diel variations in catch of ichthyoplankton are similar to variations observed in other riverine systems. Larvae are first collected at a water temperature of 8-9°C; the density peaks in mid-June as soon as 22°C is reached. Few larvae are collected by late-July. The percids appear in the ichthyoplankton first (8-9°C); crappies, suckers, and white bass follow (14-16°C); gizzard shad, carp, and freshwater drum predominate in mid-June collections (22°C); minnows make up nearly 100% of the catch late-June through August (25°C). Over a 24-h period peak drift occurs between dusk and midnight, but significant habitat and species-specific variations do exist. Critical gaps exist in our knowledge of the actual distributions of species that, because of their reproductive strategies, do not lend themselves to collection with the standard drift or towed plankton net. In addition, little information is available on the ecology of larval communities or the behavior and specific habitat requirements of many of the important commercial and sport species of the region.

(30) THE IMPORTANCE OF HABITATS ASSOCIATED WITH BACKWATER AREA CONFLUENCES AS NURSERY AREAS FOR THE FISHES OF THE UPPER MISSISSIPPI RIVER. William A. Sheaffer and Dr. John G. Nickum, Iowa Cooperative Fishery Research Unit, Iowa State University, Ames, IA 50011.

It is possible that drift of aquatic organisms and nutrients occurs between backwater areas and the main channel of the Upper Mississippi River. The drift into the main channel could result in productive areas downstream that may be utilized as nursery areas by larval fishes. The confluences of backwater areas may also provide nursery areas for larval fishes associated with the main channel. It is important that these aspects be investigated before the backwaters are lost due to sedimentation.

Three backwater areas were sampled in Navigational Pool 13 of the Upper Mississippi River from 2 April 1983 to 19 August 1983. Weekly surface and bottom tows were conducted at night in the main channel upstream and downstream from the confluences of the backwaters and in the backwaters near their confluences. Three replicates were taken at each site. Samples were sorted and larval fishes identified.

The data will be analyzed to examine differences between surface and bottom samples and between the three habitat types. This will provide insight into which species are utilizing the areas associated with backwater area confluences as nursery areas and whether the downstream sites are more productive due to inputs from the backwaters.

(31) THE ECOLOGY OF CARP ON THE UPPER MISSISSIPPI AND ILLINOIS RIVERS. K. S. Lubinski and S. D. Jackson, Illinois Natural History Survey, Grafton, IL., J. Janecek, U.S. Fish and Wildlife Service, Carbondale, IL., G. Farabee, Missouri Department of Conservation, Palmyra, MO., and A. Van Vooren, Iowa Conservation Commission, Muscatine, IA.

Since its introduction into the midwest and subsequent climb to the top of the commercial market, the carp, Cyprinus carpio, has been a major structural component of our river ecosystems. Studies conducted here and around the world have yielded a wealth of information on different aspects of carp biology, producing many of the "building-block" answers needed to achieve an integrated perspective on how carp control, and are controlled by, their environment. We have attempted to summarize the primary "knowns" and "unknowns" of carp ecology under four broad categories of knowledge: life history; abiotic relationships; biotic relationships; and ecosystem functions. Specific emphasis was placed on information applicable to the upper Mississippi and Illinois rivers. A relatively immediate need exists for information to document recent reported declines in commercial harvests and average sizes of carp, and to investigate the potential causes of the declines and whether they are short-term fluctuations or long-term trends. If the declines continue, the concept of carp harvest as a perpetually abundant resource will have to be abandoned.

(32) NESTING SUCCESS AND FEEDING BEHAVIOR OF GREAT BLUE HERONS ON THE MISSISSIPPI RIVER NEAR CASSVILLE, WISCONSIN AND EAST DUBUQUE, ILLINOIS. G. W. Kaufmann and E. T. Cawley, Department of Biology, Loras College, Dubuque, IA 52004-0178.

Nesting Great Blue Herons (Ardea herodias) were studied on Brinkman's Island near Cassville, Wisconsin and on Catfish Island near East Dubuque, Illinois during the breeding seasons of 1978, 1980-83, and 1982-83, respectively. Eggshells and unhatched eggs dropped from nests indicated 94% (n = 1145) of the eggs hatched. Nests contained an average of 2.3 to 3.3 young sufficiently large to be visible from the ground and an average of 1.8 to 3.0 birds survived to fledging. U.S. Fish and Wildlife band recoveries of known age birds (1186) were most frequent from juveniles (66%) and the majority (98.6%) were from birds less than 11 years old. However, two birds survived to ages 44 and 45.

Eighty-six fish of 24 species were found beneath the nest. Stomach contents of dead young found beneath nests contained insects, crayfish, rodent hairs, and fish. Adult herons were attracted to feed near artificial decoys in areas of both high and low feeding use. Feeding herons in the East Dubuque area appeared to be habituated to heavy boating use and were less easily disturbed than those in the Cassville area.