# *Update of Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMRERS)*

***Tatsuaki Nakato***
***LACMRERS***
***IIHR – Hydroscience & Engineering***
***College of Engineering***
***The University of Iowa***
***19 August 2005***

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# TOPICS

1. Research and Educational Activities at LACMRERS
2. Bank-Erosion Study of the UMR
3. Size and Age Distributions of Freshwater Mussels Consumed by Muskrats near Fairport, Iowa

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# *Fairport Federal Biological Research Station was Built in 1914*


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***From the photo at the Fish Hatchery***

# *Pearl Button Industry*

- ***Mass harvest caused decline in mussels on river***
- ***Land donated by Association of Button Manufactures***
- ***Purpose - Freshwater mussel research and propagation***

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***Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMRERS) was built in May 2002***


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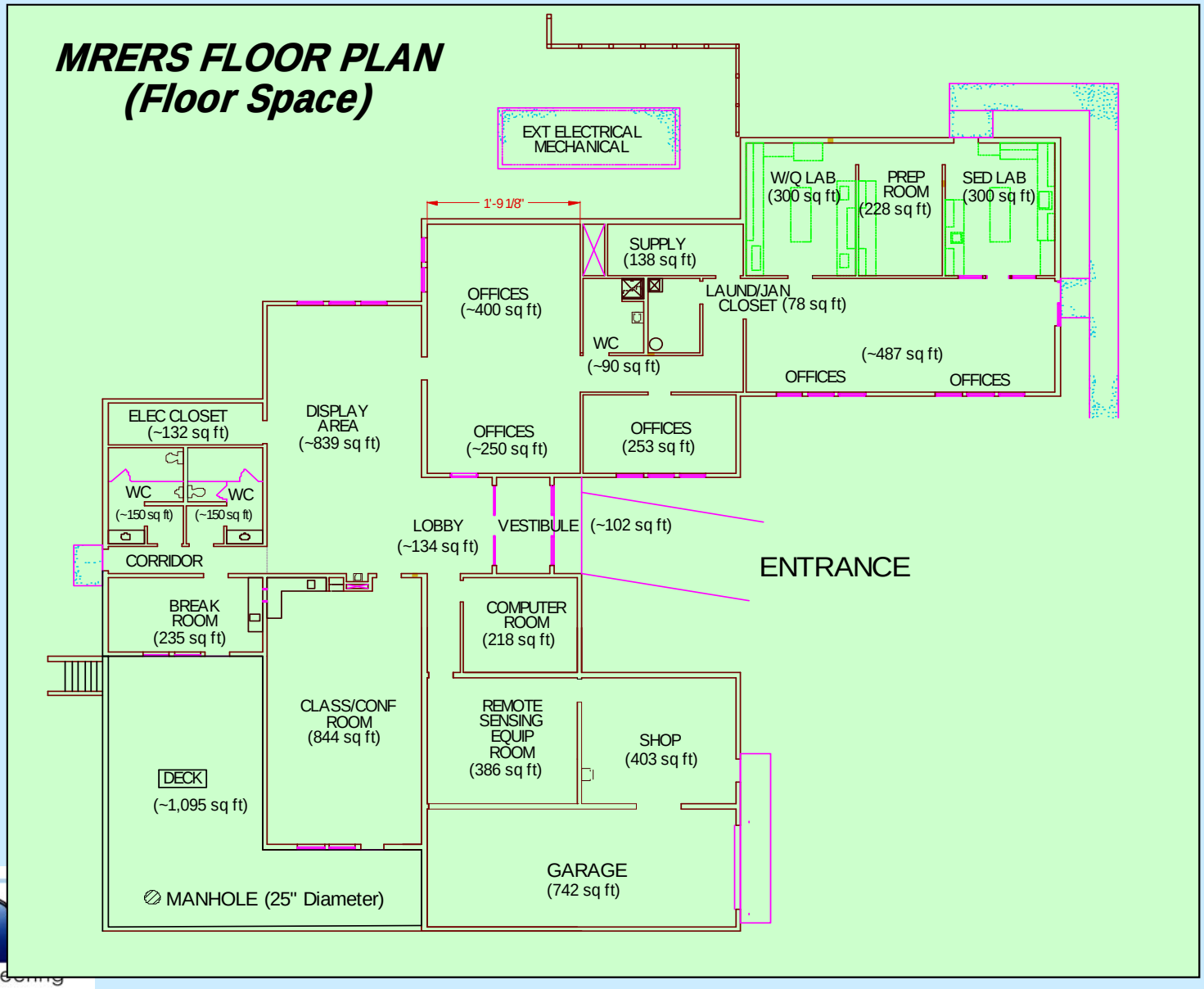
# Detailed Floor Plan

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# *LACMRERS MISSION STATEMENT*

- ***LACMRERS will provide opportunities to area schools and universities to develop and conduct field-based educational programs, including short courses and workshops for industry and government agencies;***
- ***LACMRERS will provide an environment and state-of-the-art field experiment facilities for multi-disciplinary education and research on large-river ecosystems;***
- ***LACMRERS will establish partnerships with government, industry, universities and private organizations to enhance understanding of large-river ecosystems;***

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# *Cont'd*

- ***LACMRERS will coordinate its activities with river-monitoring stations along the Upper Mississippi and provide avenues for public dissemination of river data; and***

- ***LACMRERS will apply IIHR's established strengths in engineering hydraulics, computational fluid dynamics, and remote-sensing technology to understand river ecology in partnership with researchers in other disciplines, such as agriculture, meteorology, and urban and regional planning.***

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# LACMRERS October 2003

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# Frozen Mississippi

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# *Spiny Softshell Turtle*

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# Spiny Softshell Turtle

# Large Snapping Turtle

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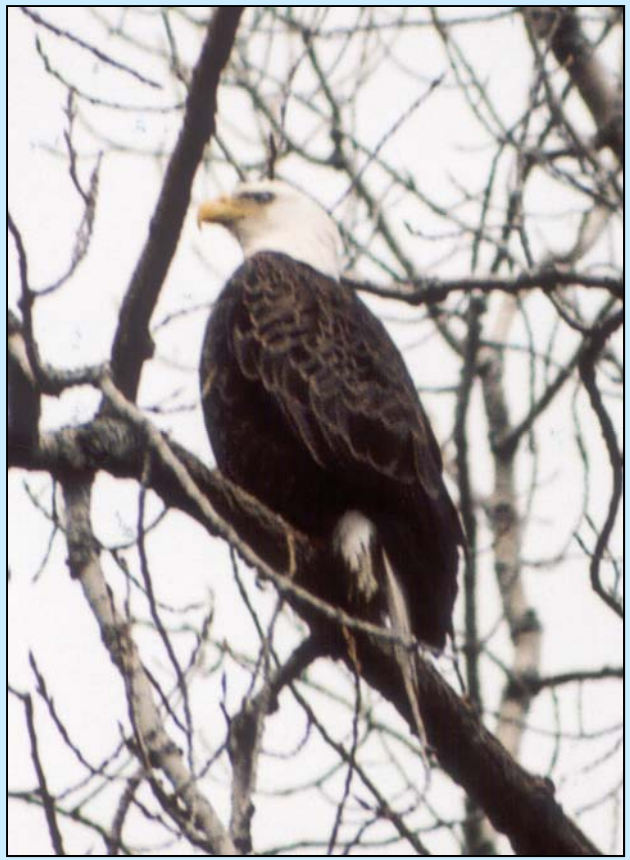
# *Bald Eagles in Fairport, March 2004*



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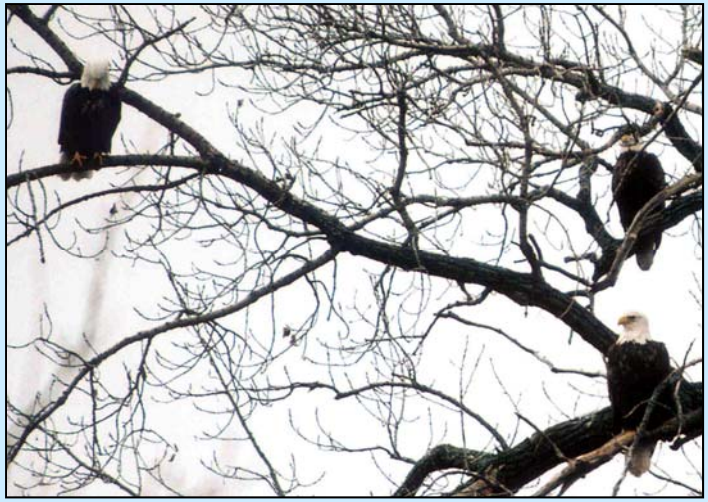
# *Cautious Bald Eagles in Fairport, Feb 2005*



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# *A Beautiful Hog-Nose Snake*

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# *Would you like to see him coming at you?*

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# *He is coming ---!!*

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# *Here he comes!!*

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***Red-tail hawk trapped in McGregor***

***Red-tail hawk ready to take off after tagging***

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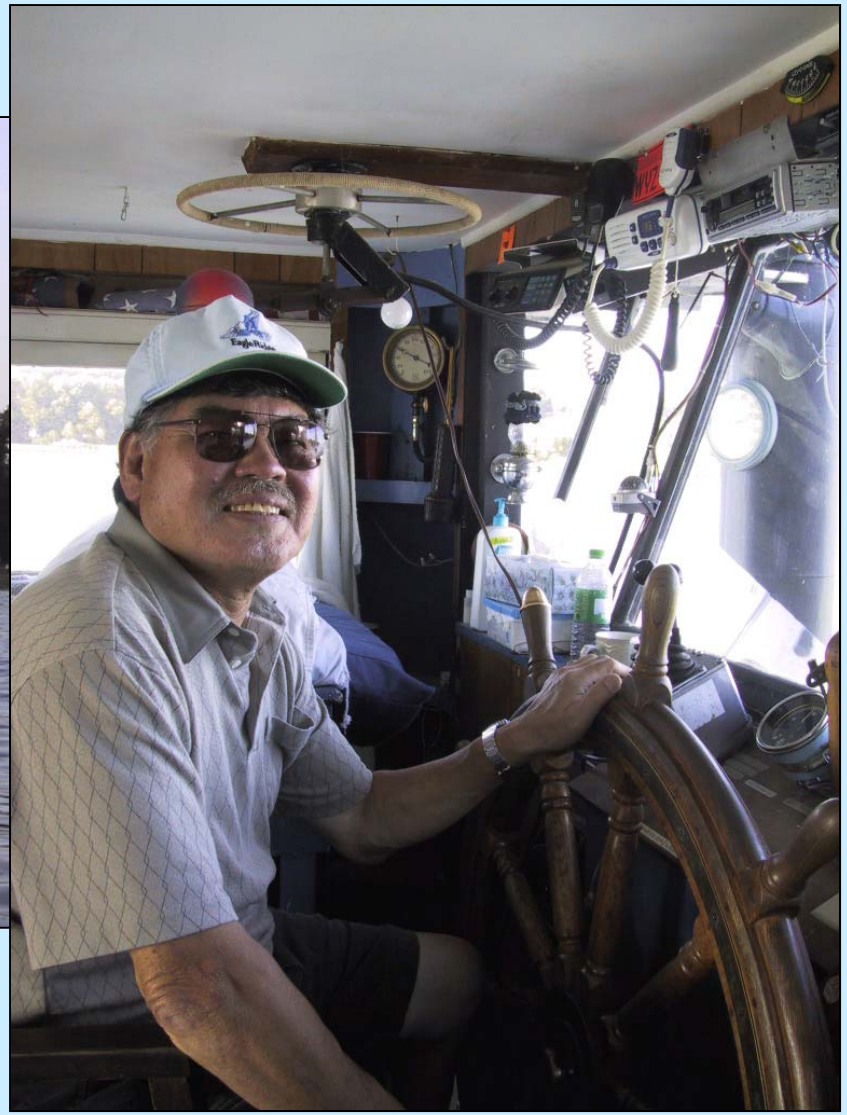
# *Excursion on the Mississippi River aboard Lilly Belle owned by Audubon Society*



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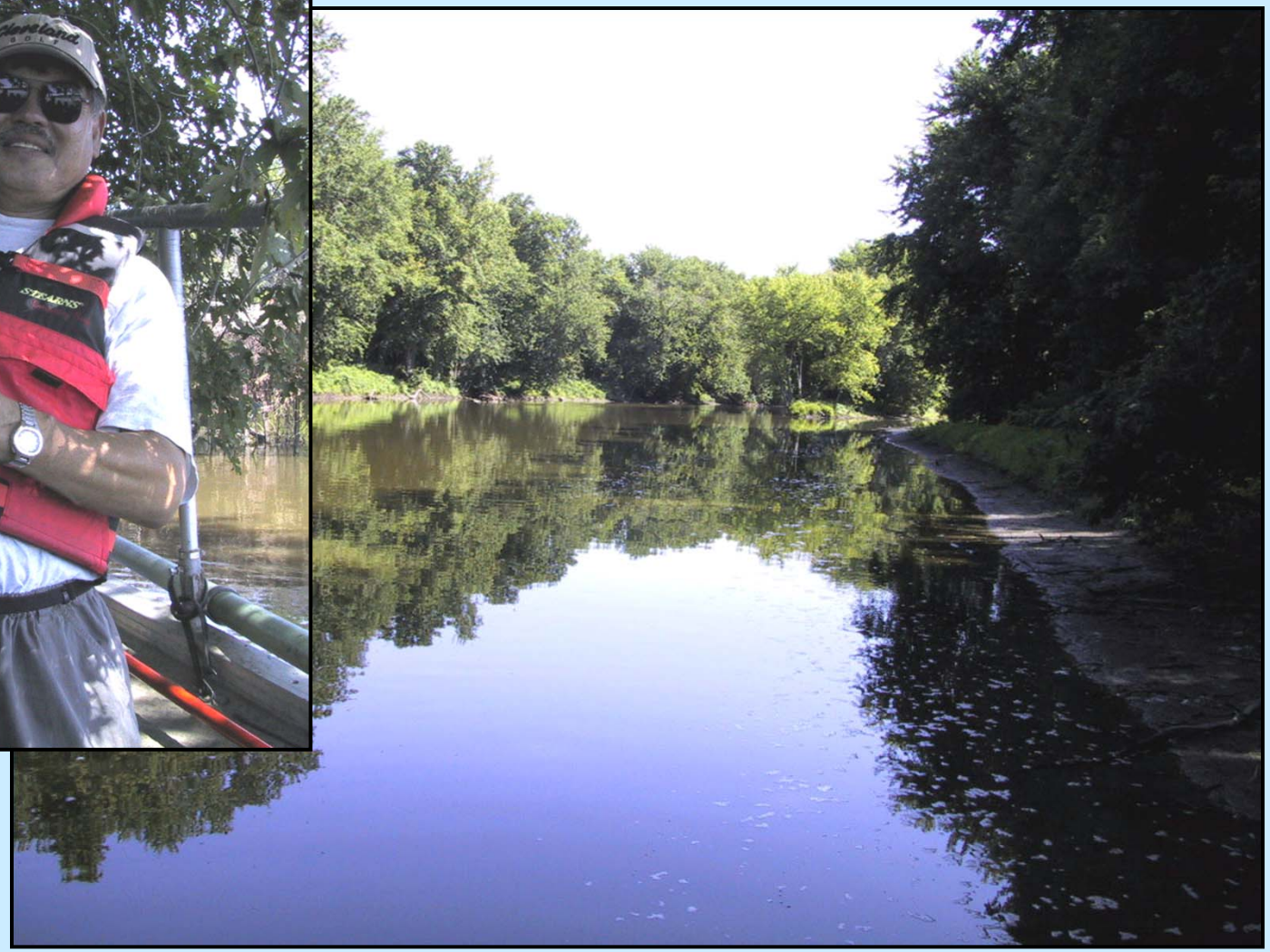
# *Quiescent Backwater in Pool 16*

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# 18 June 2003
# Huge Flatheads
# Caught in Pool 17

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# *June 2004 (Mike Rush)*
# *Record Blue Catfish – 101 lbs,*
# *Bellevue, NE on the Missouri River*

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***Lake Sturgeon caught in Davenport below L&D 15 on the Mississippi River***

***Population Decrease due to Illegal Fishing for Caviars***

***To 8' & 300 lbs, lives over 150 yrs***

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# Paddle Fish in Pool 13, Bellevue, IA

***To 7' & 200 lbs;***
***Lives up to 30 yrs;***
***Takes 8 yrs to mature***

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# Paddle Fish in Pool 13

***Layers of Filters in the mouth***

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# *Lamprey fish and their attachment marks on paddle fish*

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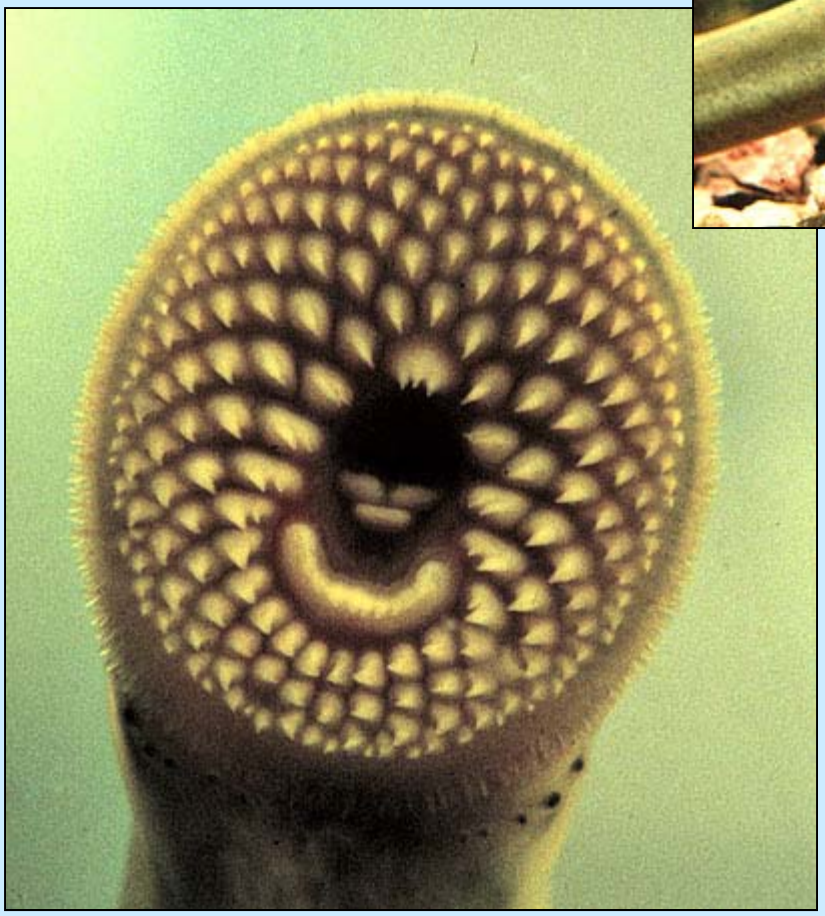
# *Chestnut Lamprey*



***Sucking-cup mouth, wider than the body when expanded, drills into the fish with its tongues and teeth (~15”) – host fish becomes colorless afterward***

# Northern Pike in Pool 11, Guttenberg, IA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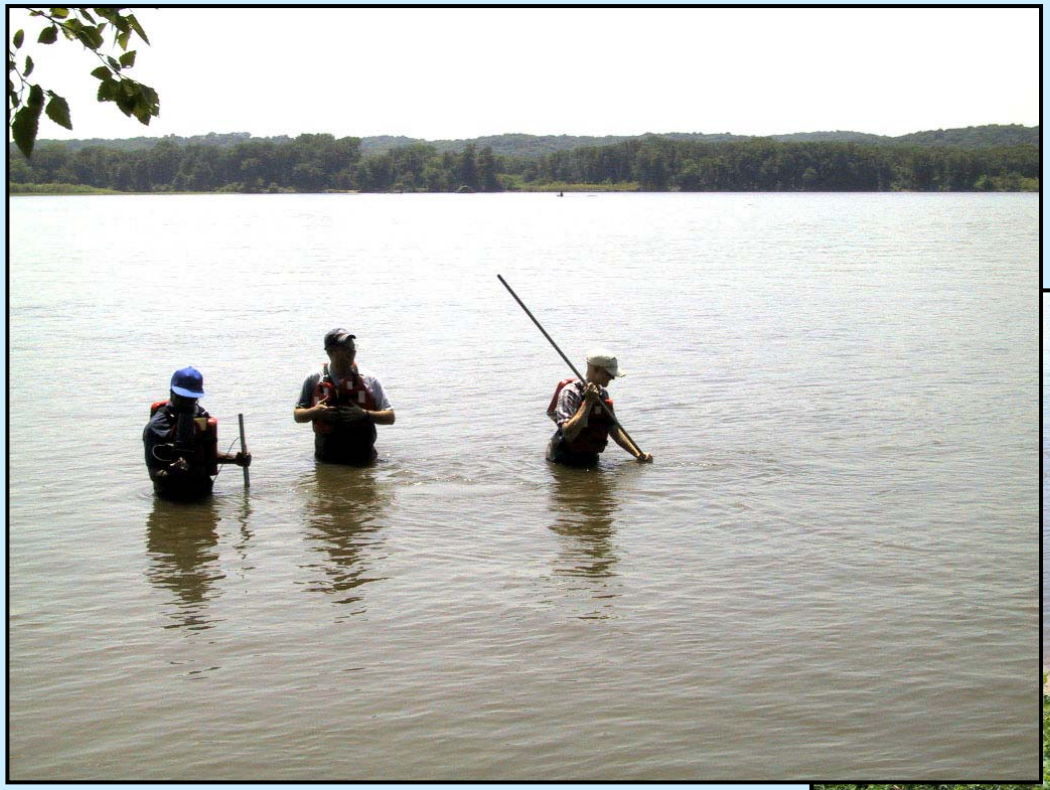
# *Search for MR Mussels*
# *July 2002*



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# 3 July 2002


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***Giant floater and threeridge covered by zebra mussels - July 2004***

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# *July 2004*

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# Display Cases (November 2004)


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***Higgins eye mussels (federally endangered)***

***Higgins eye, Hickorynut, Butterfly, Monkeyface, etc.***

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# *Sample Shells*

***Clockwise from Left Top:***

- ***Mapleleaf***
- ***Wartyback***
- ***Monkeyface***
- ***Hickorynut***
- ***Butterfly (Center)***

# *Lampsilis Higginsis*

***Exterior of Higgins Eye mussel***

***Interior of Higgins Eye mussel***

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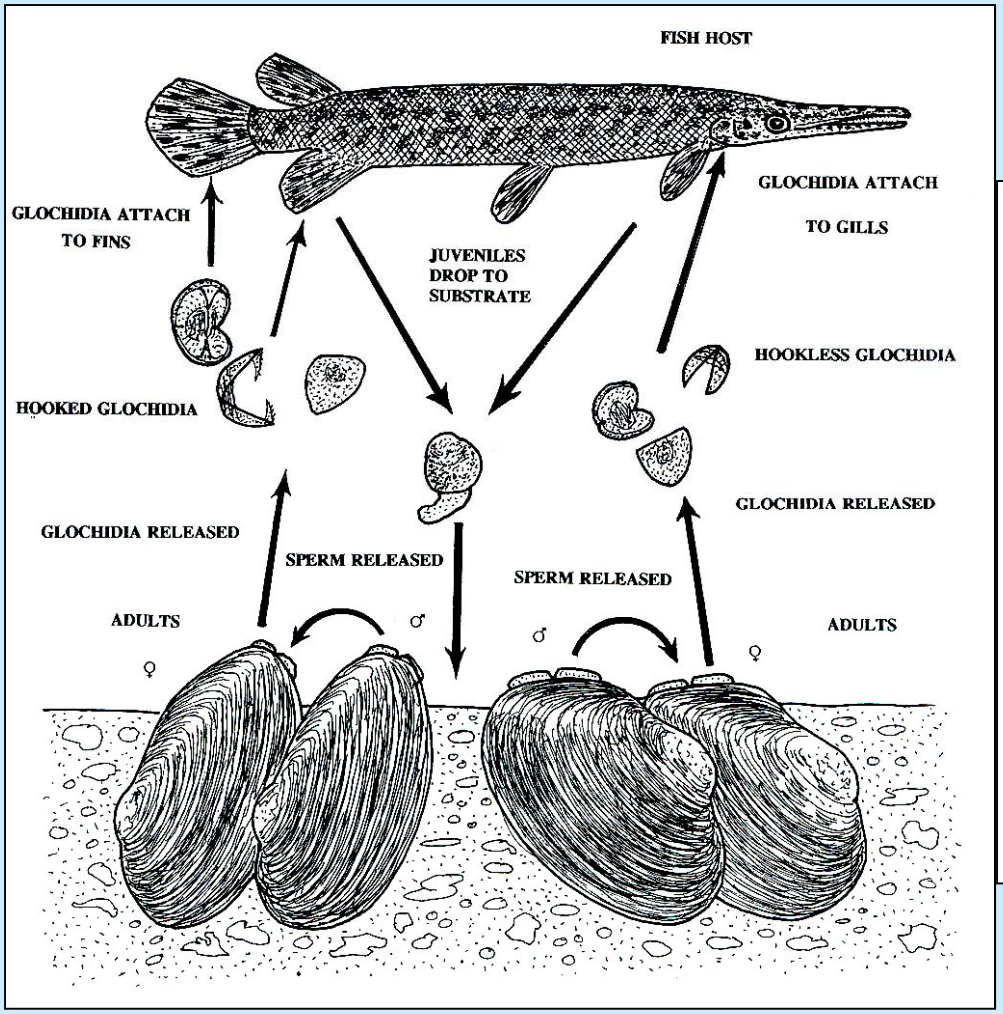
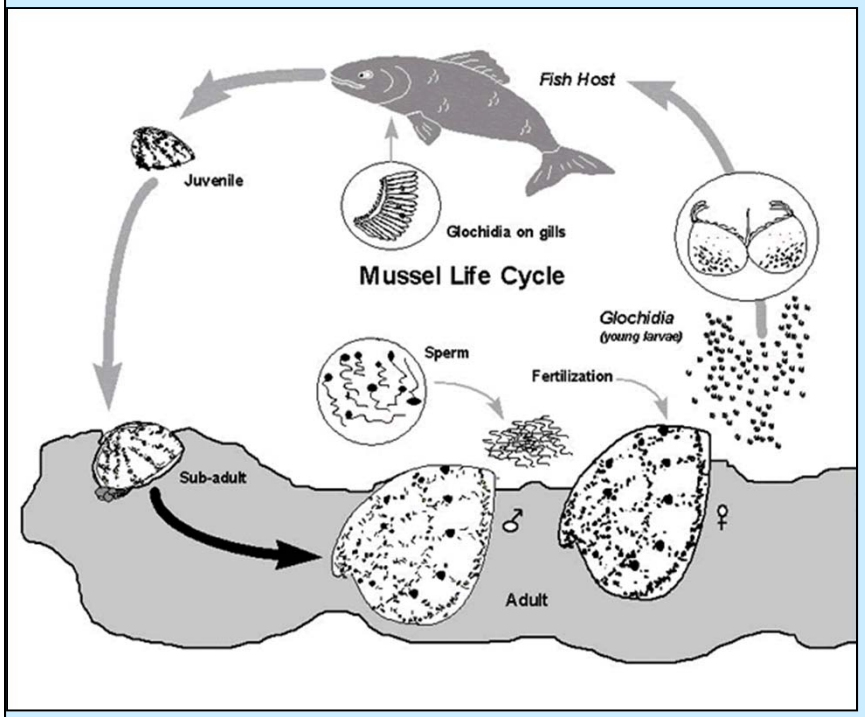
# Freshwater Mussel Reproductive Cycle

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## *Higgins eye mussel display*

## *Pocketbook mussel display*


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***Glochidia extraction***

***Extracted glochidia***

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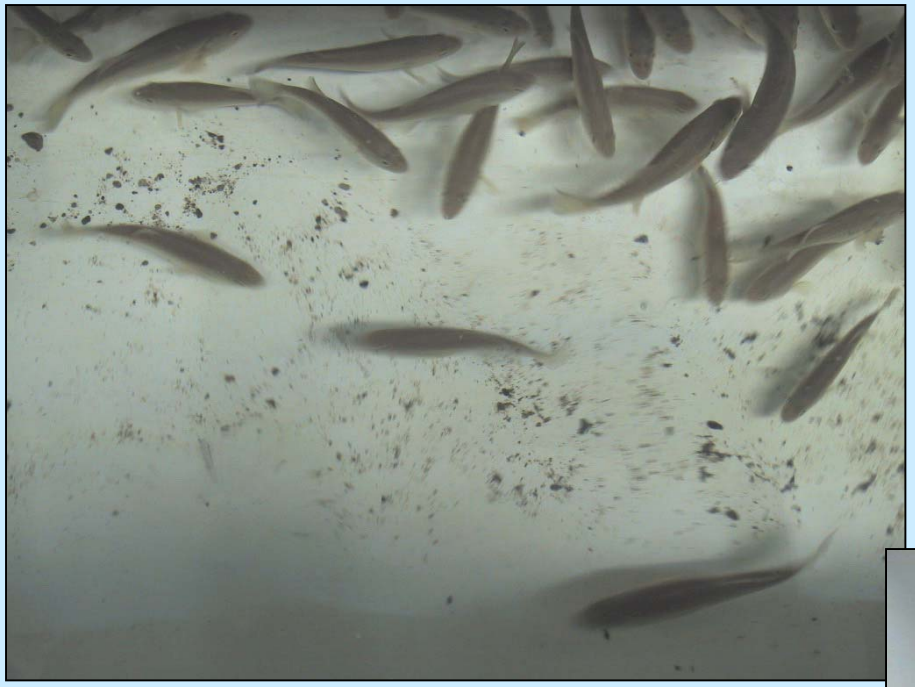

***Inoculated small-mouth bass***

***Checking glochidia attached to gills***

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# *Mussel Cages were brought to LACMRERS and given final touches*

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***15 May 2004***
***Release of bass inoculated with Higgins Eye glochidia***

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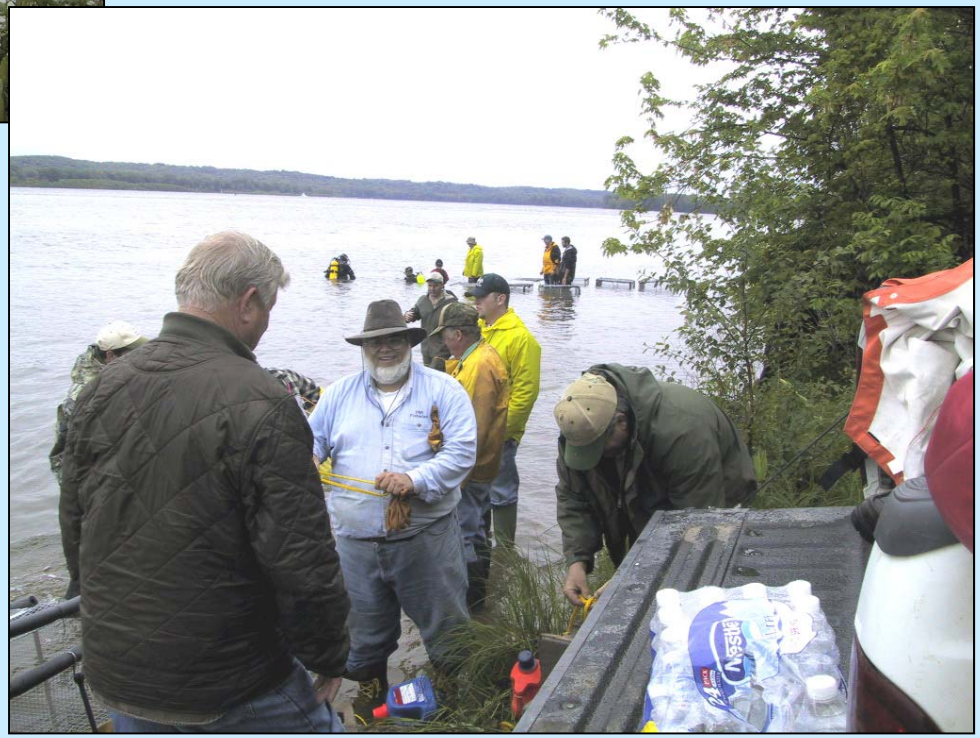
# *13 September 2004 - Recovery of cages to inspect growth of Higgins Eye mussels*



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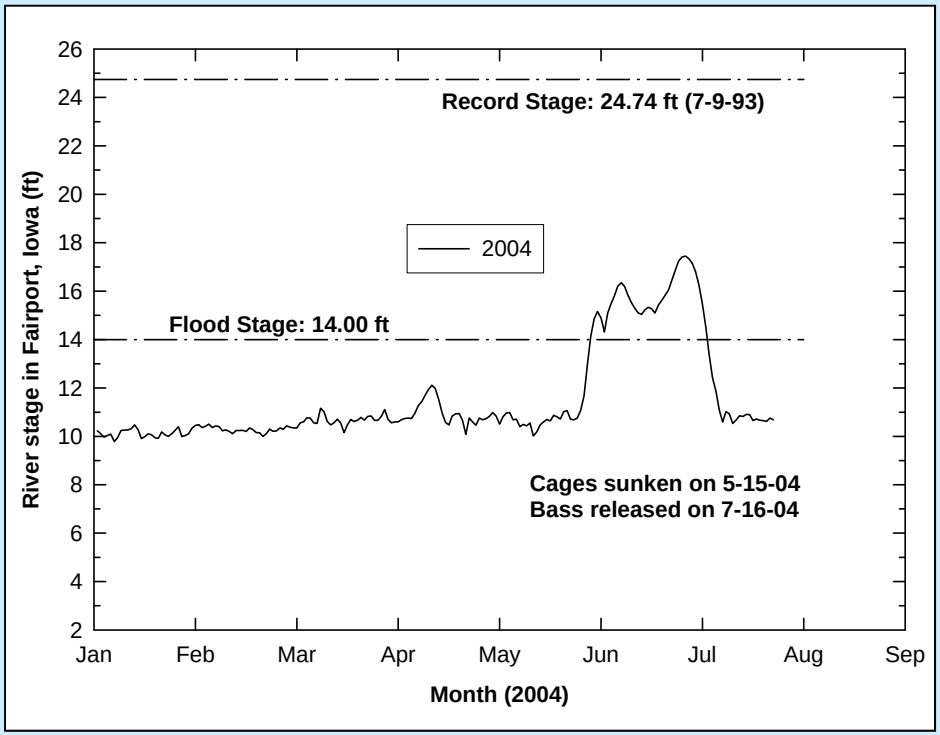
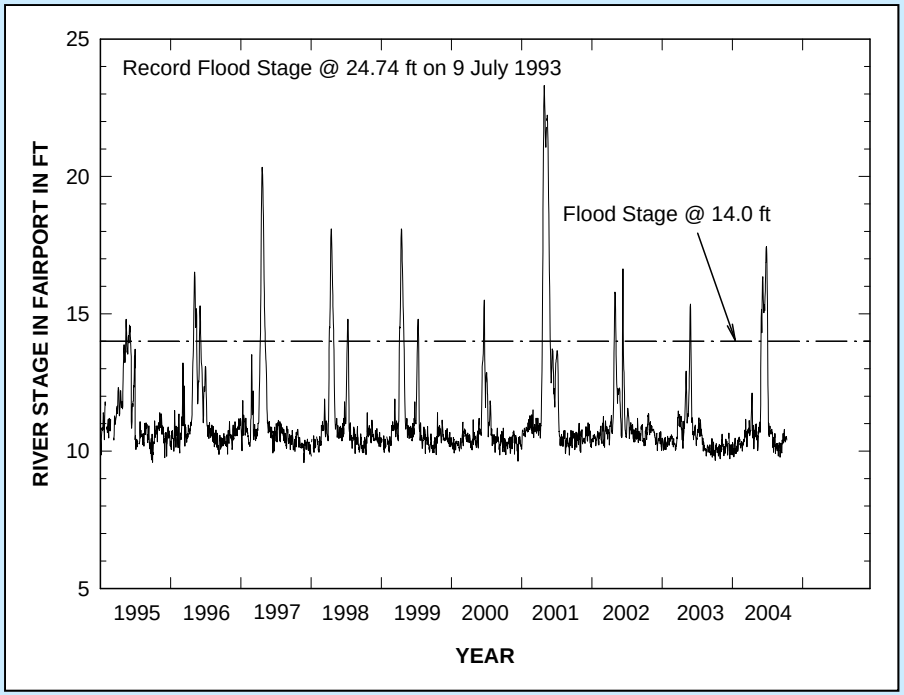



# 2004 Hydrograph at Fairport, Iowa in Pool 16

# Hydrograph at Fairport, Iowa in Pool 16 for the past ten years

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***Divers bring cages to the shore for inspection***

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***Looking for Higgins Eye mussels, but nothing but mud***


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***Volunteers carry heavy mud-filled cage for inspection***

***A tiny bluegill was found***

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***13 September 2004***
***Empty steel cages wait for retreat instead of returning to the river bottom with baby Higginsis***

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## *13 September 2004 Check for live mussel species*

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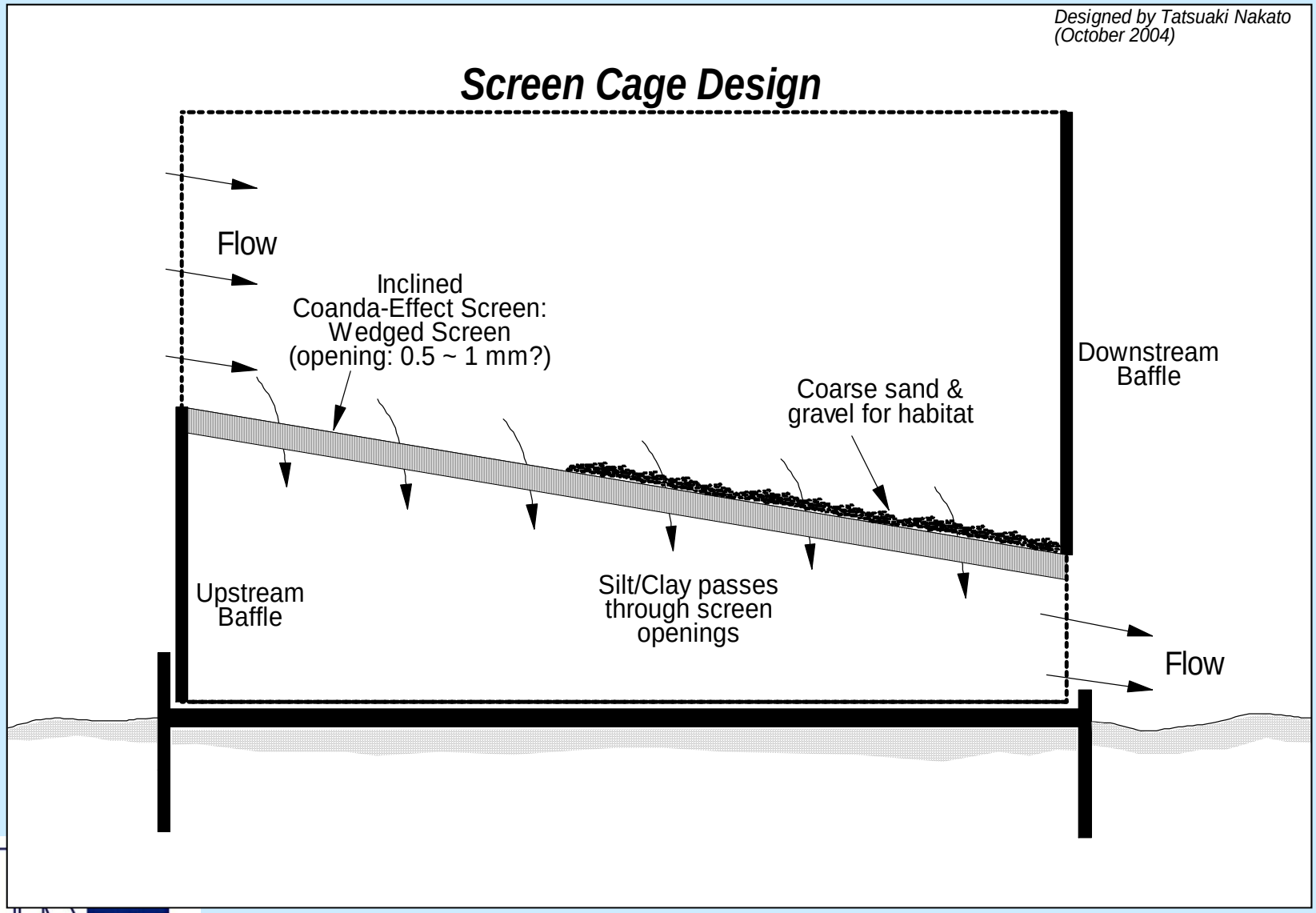
# Proposed Mussel-Cage Design

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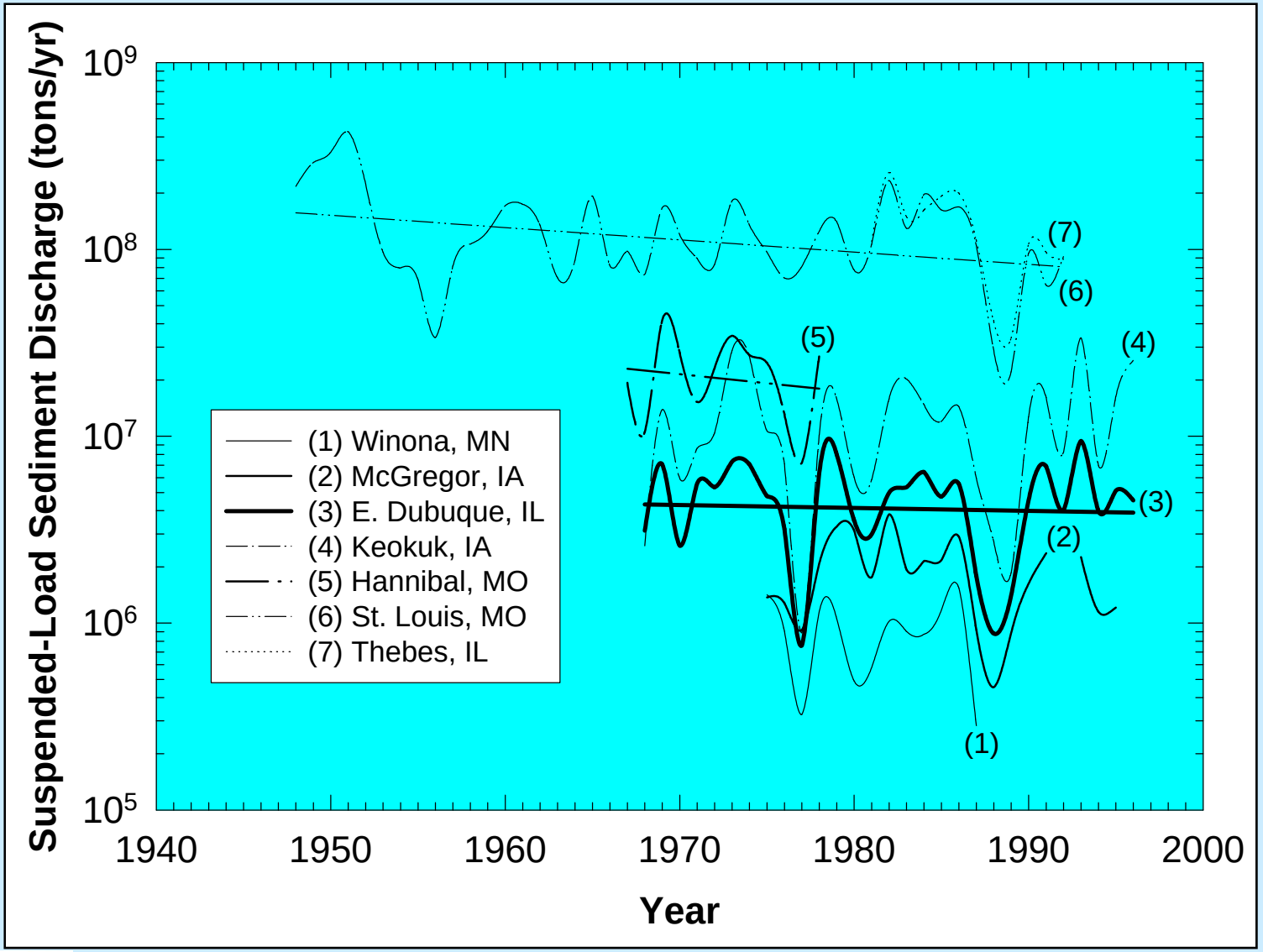
# Temporal $Q_s$ along UMR

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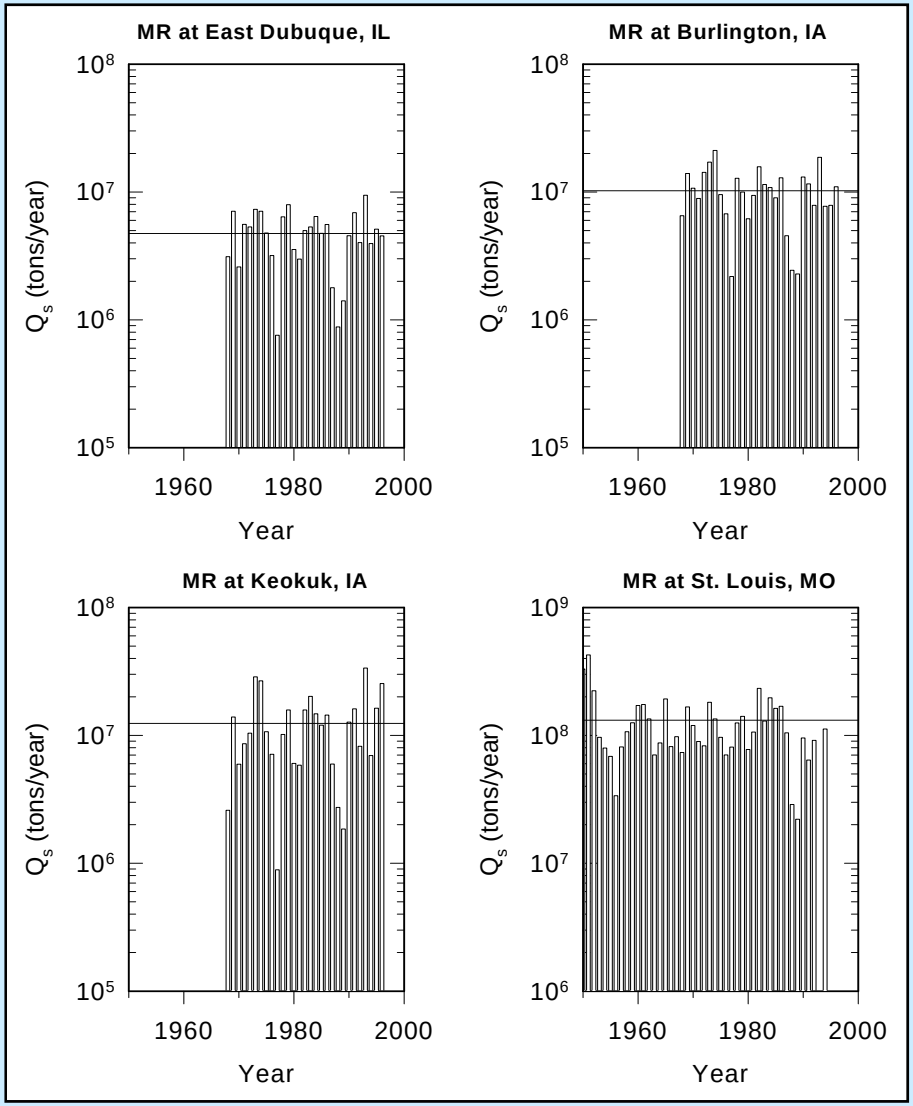
# $Q_s$ at Major UMR Stations

***Average $Q_s$:***

- ***~5M t/yr at E. Dubuque***
- ***~10M t/yr at Burlington***
- ***~13M t/yr at Keokuk***
- ***~132M t/yr at St. Louis***

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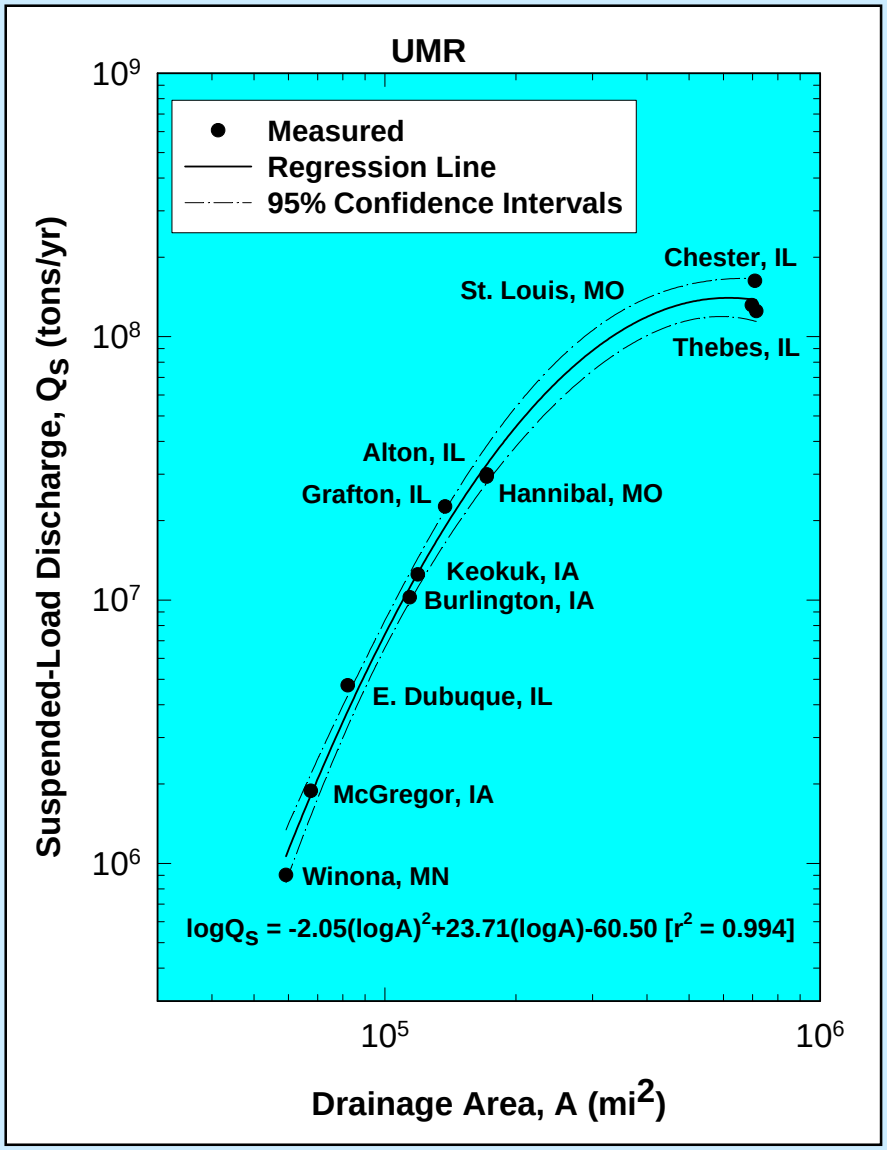
# $Q_s$~A Relationships for UMR Stations

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# *Suspended Sediment Transport Rates along the UMR: Summary*

- *Along the main UMR stem, $Q_s$ increases toward the downstream direction:*
  - *0.9M t/yr at Winona, MN (RM 725.7 - 1,168 RK)*
  - *170M t/yr at Thebes, IL (RM 44.0 – 71RK)*
- *Significant correlation was found between $Q_s$ and A for the UMR*
- *A periodic high $Q_s$ was found to occur every 8~10 yrs for the most tributary & UMR records*

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# *Good News*

# 3-Yrs Old Higgins Eye Mussels Growing in Lake Pepin (5/18/05)

# Mussels in the cage

# Mussels Returning to River Bottom

# LACMRERS Tunnel Boat and ADCP Unit Mounted on it



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# *Old Bathymetric Survey Boat and our New Tunnel Boat*

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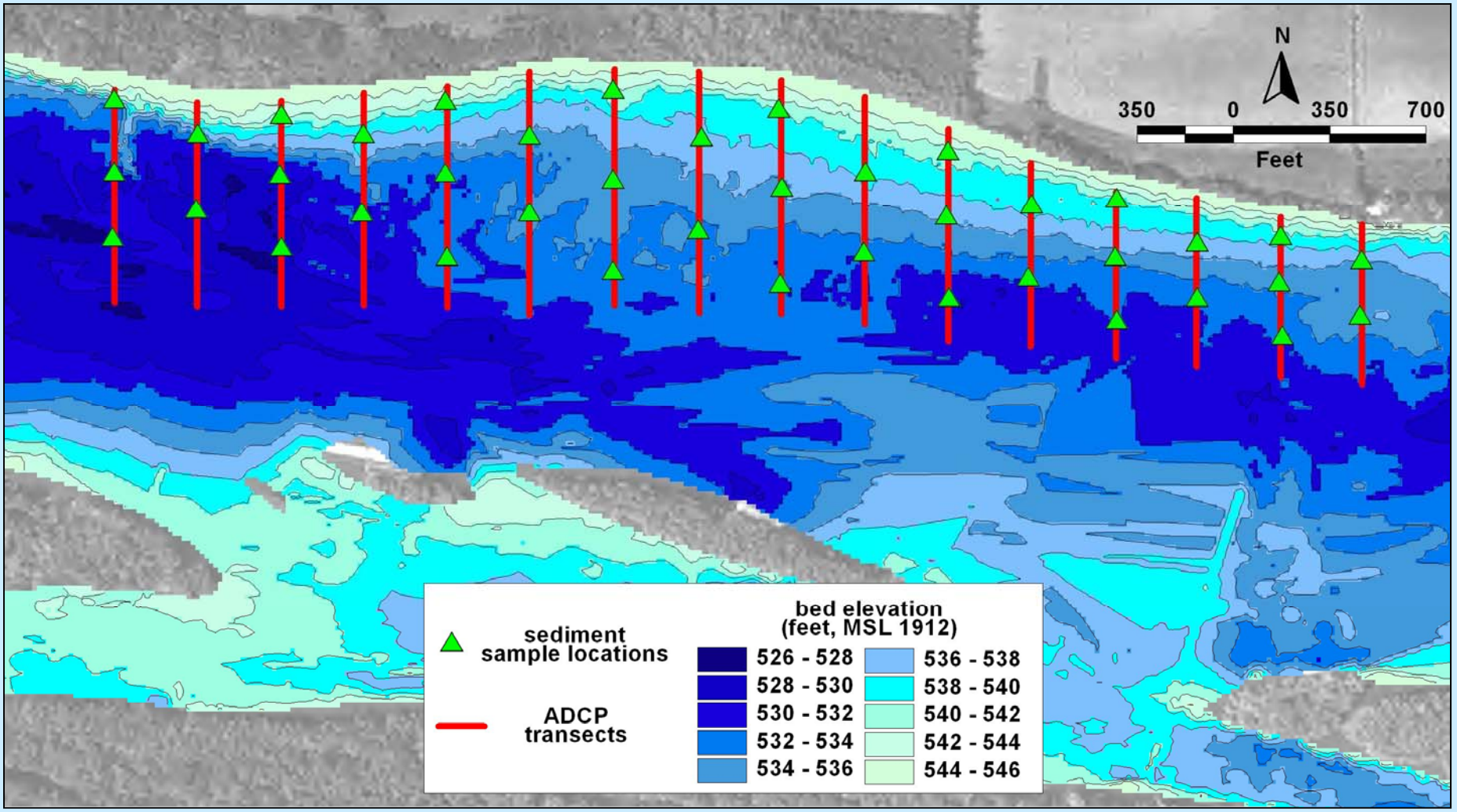
# *Characterization of Mussel Bed in Buffalo, Iowa*

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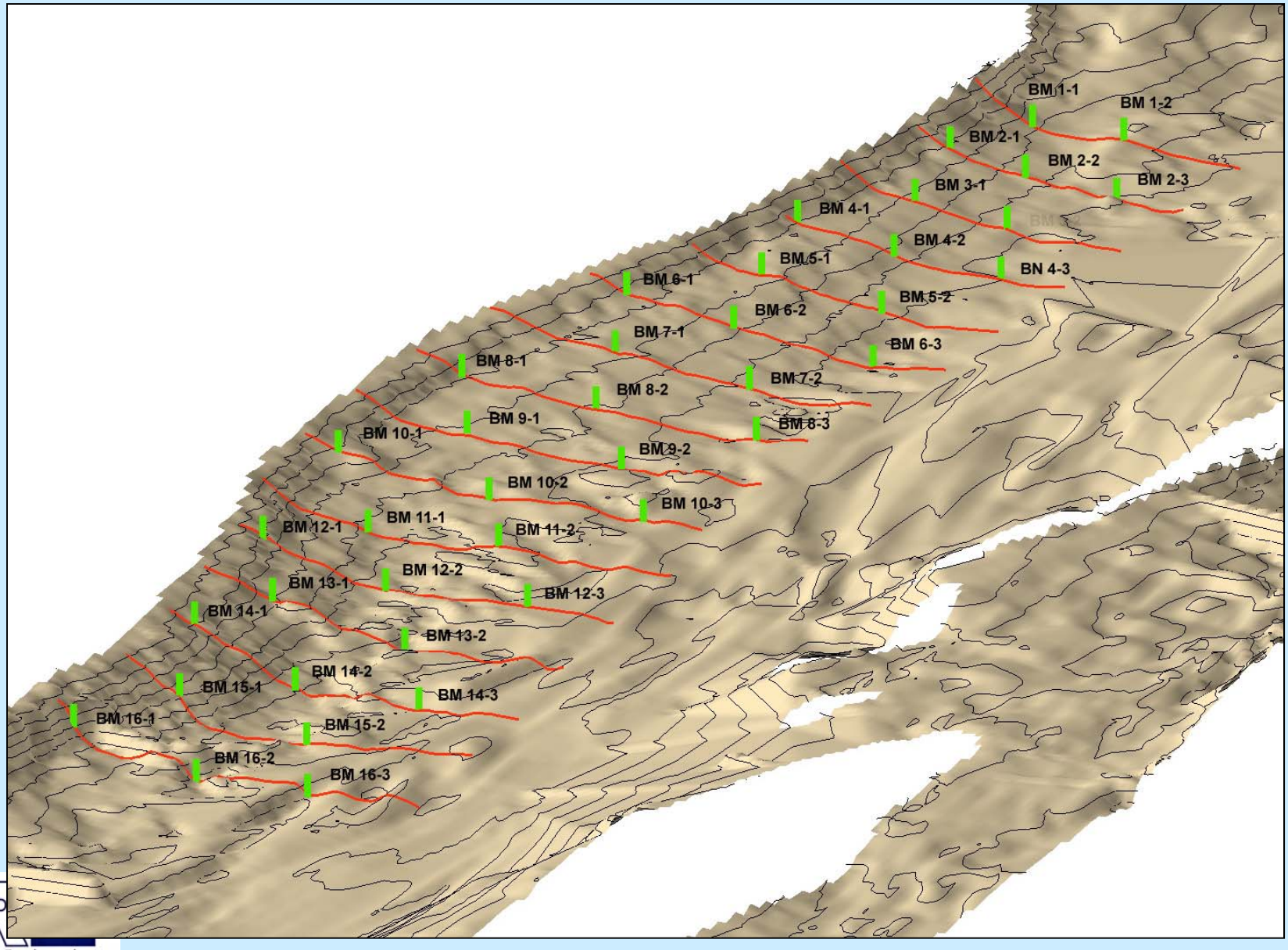
# Bed Topography Recently Mapped

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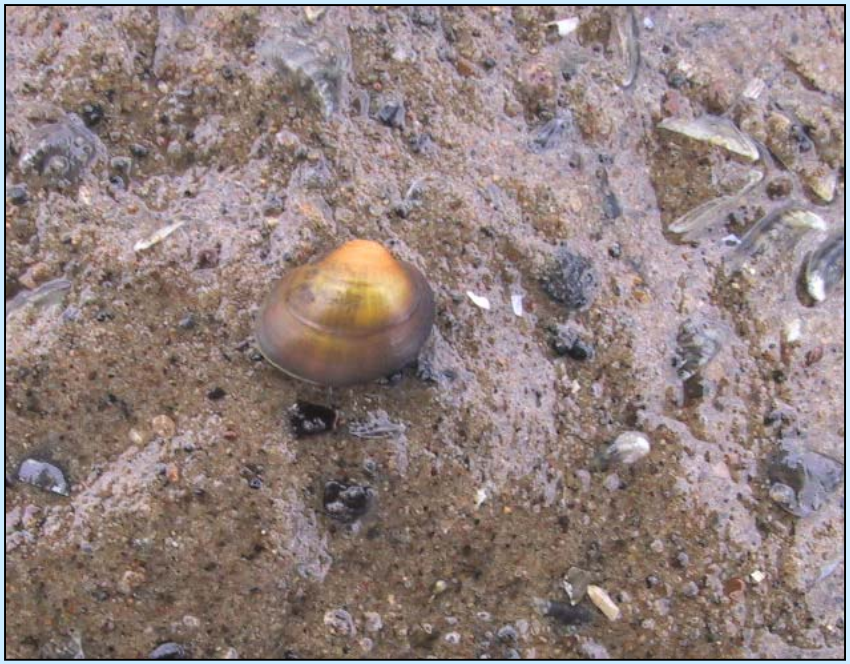
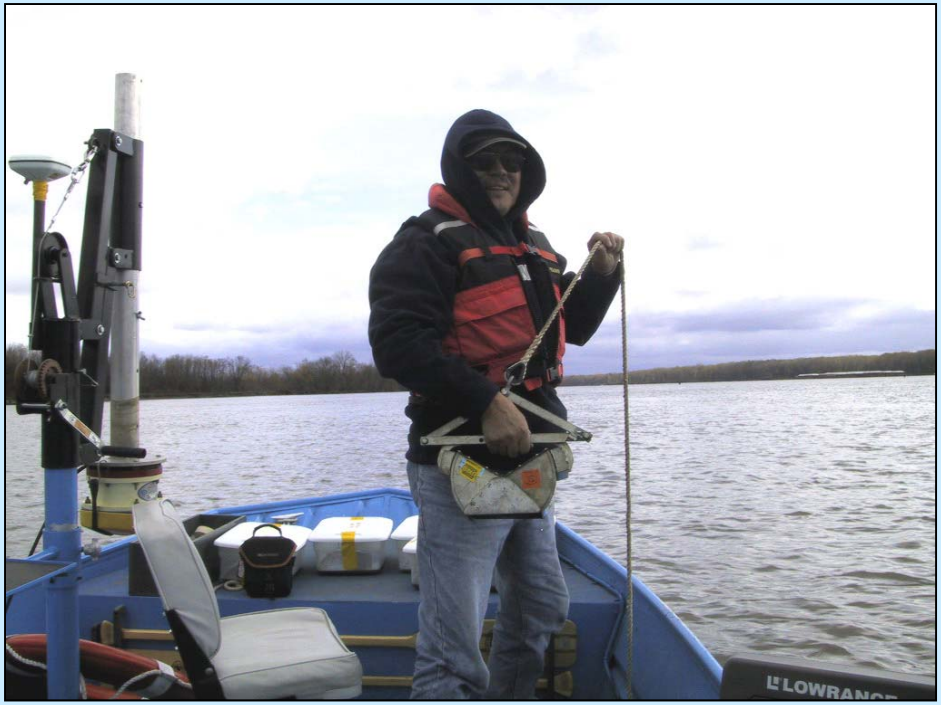
# Bed Material Sampling and a Juvenile Higginsi Mussel Found



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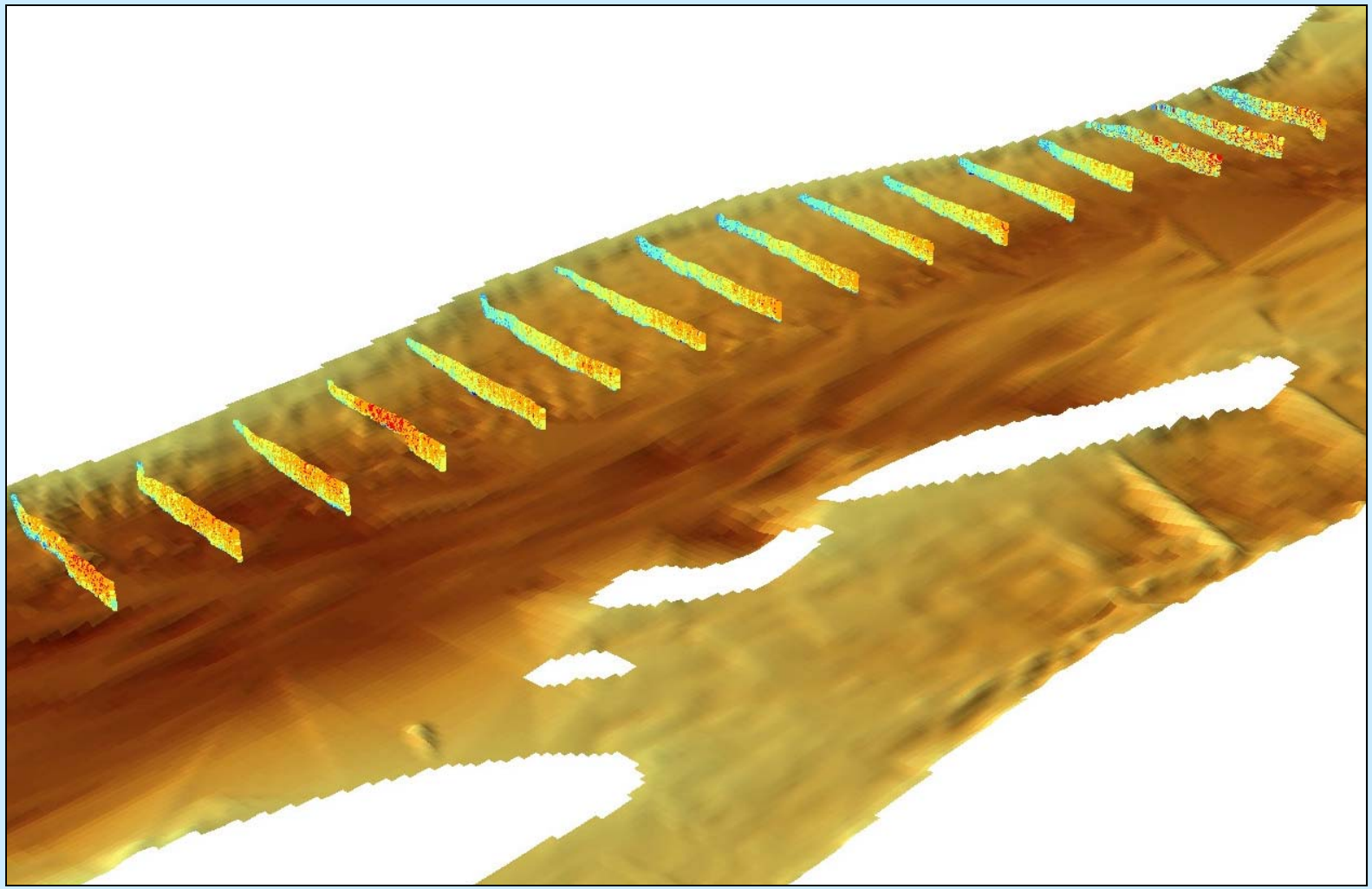

**Preliminary results of velocity profiles obtained by ADCP**

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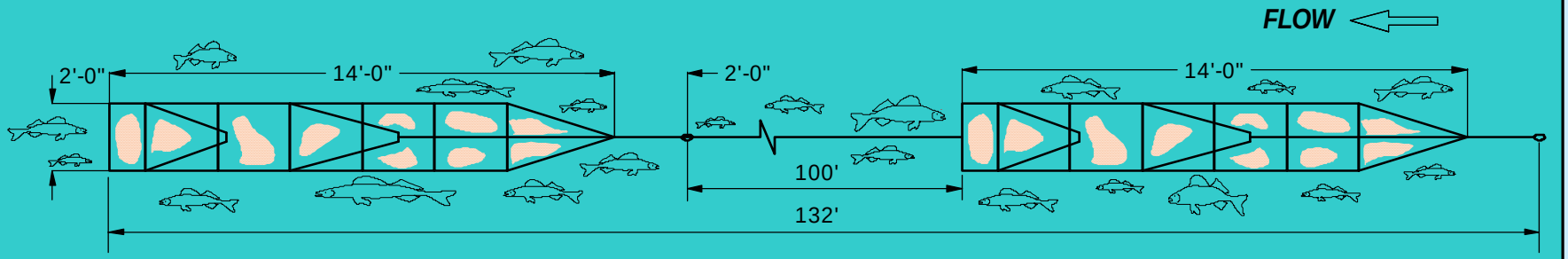
# Tandem Hoop Nets to be Used in April 2005 to Check Host Fish Species at Buffalo Site

## 2' diameter hoop nets in tandem set up




1. Upstream Stake: 5 ft long, 1/2 in. rerod
2. Anchor Rope: 50 ft of #120 nylon rope bridled to downstream net
3. Anchor: Half concrete block, one each
4. Tandem Net Set: Tie with #120 nylon rope, 100 ft long

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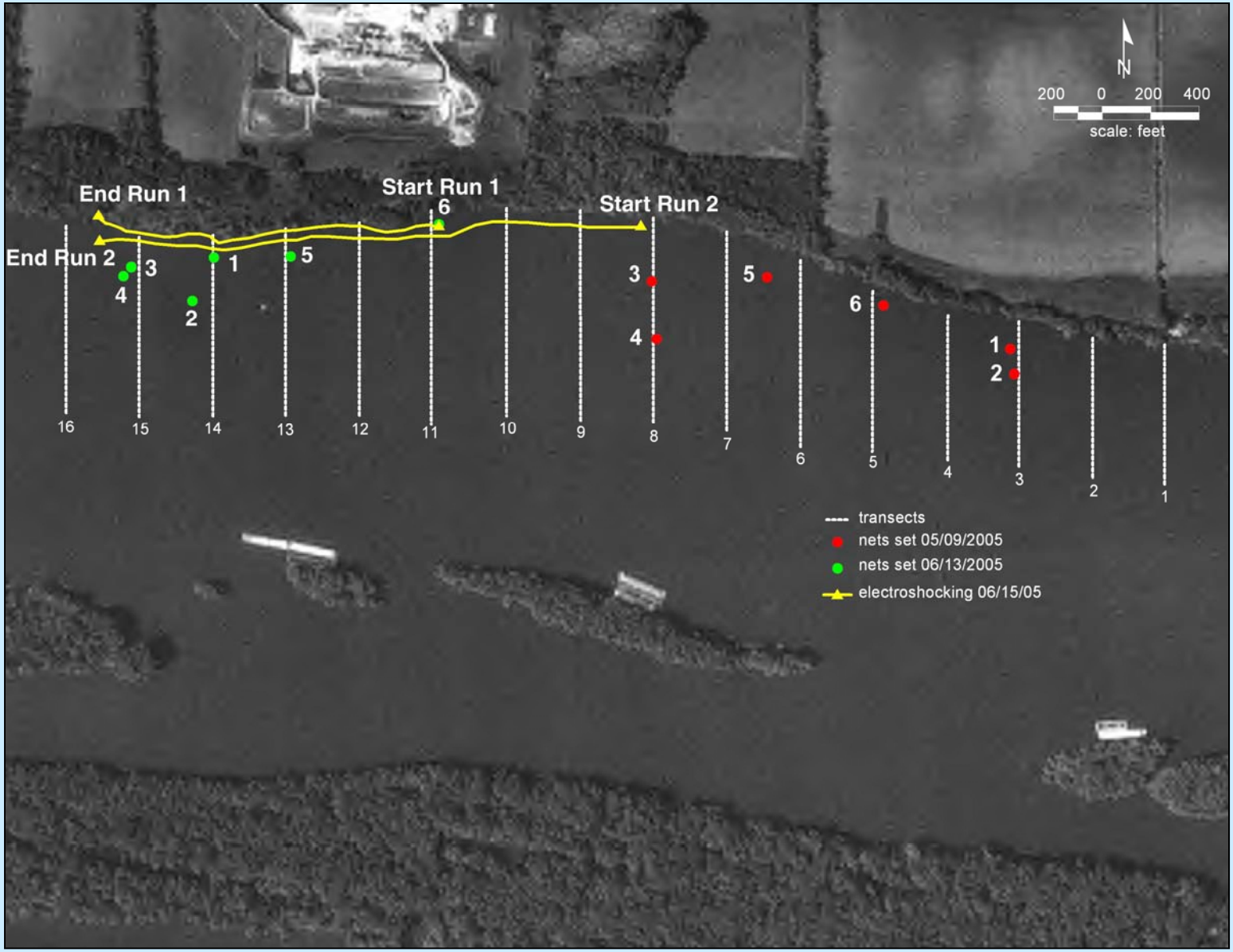


**Locations for hoop nets and approximate routes of electrofishing**

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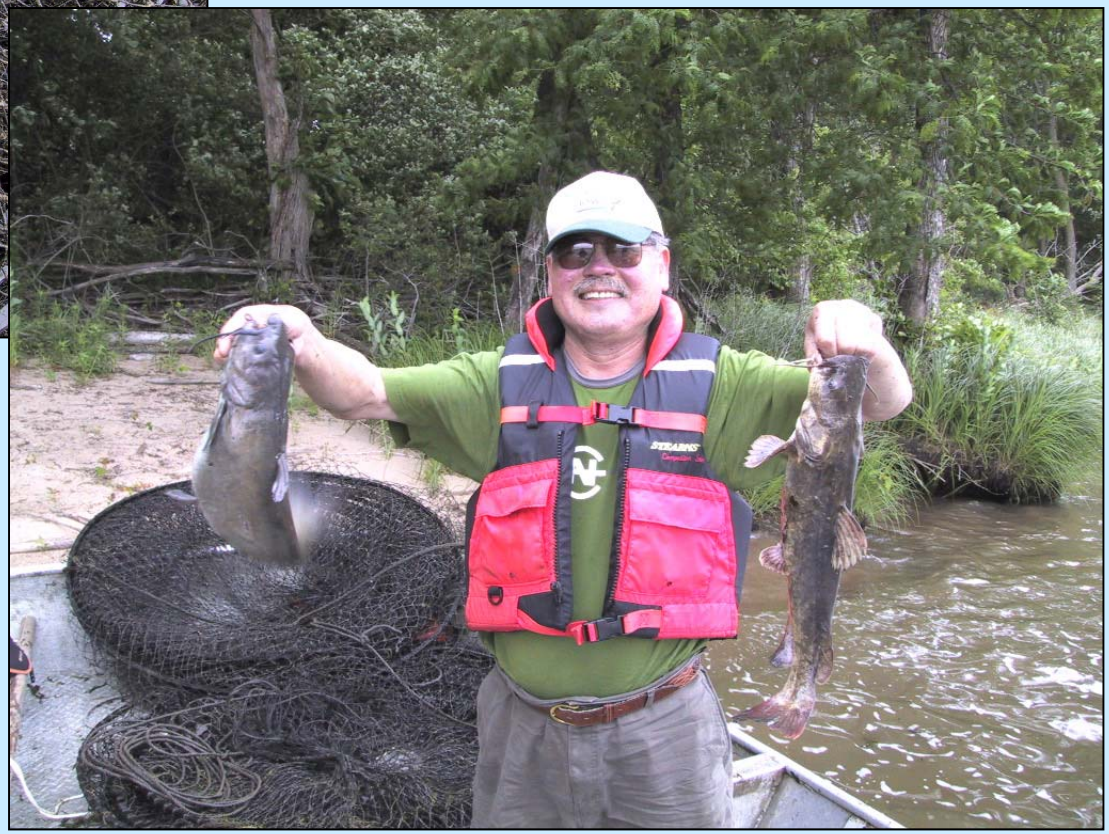
# Fish caught in hoop nets



**Buffalo mussel habitat**
**Hoop net sampling 06/13/2005-06/14/2005**

| site | net size (ft) | net | float location | | float attachment | set | | | | collected | | | species | length (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Latitude (decimal degrees) | Longitude (decimal degrees) | | date | time | water temp (F) | depth (ft) | date | time | water temp (F) | | |
| **1** | 2 | upstream | 41.4527 | 90.76984 | weights | 6/13/2005 | 10:50 | 81 | 7.3 | 6/14/2005 | 10:10 | 79 | | |
| | | downstream | | | | | | | | | | | | |
| **2** | 2 | upstream | 41.4522 | 90.77018 | weights | 6/13/2005 | 11:15 | 81 | 17.0 | 6/14/2005 | 10:15 | 79 | | |
| | | downstream | | | | | | | | | | | | |
| **3** | 2 | upstream | 41.4526 | 90.77109 | weights | 6/13/2005 | 11:25 | 81 | 13.0 | 6/14/2005 | 10:20 | 79 | flathead catfish | 21.0 |
| | | | | | | | | | | | | | freshwater drum | 9.4 |
| | | | | | | | | | | | | | freshwater drum | 9.6 |
| | | downstream | | | | | | | | | | | flathead catfish | 16.3 |
| | | | | | | | | | | | | | freshwater drum | 9.1 |
| | | | | | | | | | | | | | freshwater drum | 9.1 |
| **4** | 2 | upstream | 41.4525 | 90.77121 | weights | 6/13/2005 | 11:40 | 81 | 15.5 | 6/14/2005 | 10:25 | 79 | freshwater drum | 9.5 |
| | | downstream | | | | | | | | | | | | |
| **5** | 4 | upstream | 41.4527 | 90.76869 | downstream net | 6/13/2005 | 11:50 | 81 | 7.5 | 6/14/2005 | 10:30 | 79 | | |
| | | downstream | | | | | | | | | | | | |
| **6** | 4 | upstream | 41.453 | 90.76645 | downstream net | 6/13/2005 | 12:05 | 81 | 7.0 | 6/14/2005 | 10:35 | 79 | freshwater drum | 17.1 |
| | | | | | | | | | | | | | channel catfish | 23.3 |
| | | downstream | | | | | | | | | | | freshwater drum | 13.4 |
| | | | | | | | | | | | | | flathead catfish | 21.0 |

Notes: 1. one live pimpleback (~ 5 years) and two entact threeridge shells found in nets at site 5
2. velocity of 1.97 fps measured between sites 1 and 2 at 12 ft depth

# Results of hoop-net sampling on 13 June 2005

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# Silver redhorse captured in Run 1

**Buffalo mussel habitat**
**Electroshocking 06/15/2005**

| | | | | |
|---|---|---|---|---|
| type | pulsed DC | | boat operator | Jon Christensen |
| volts | 672 | | netter(s) | Tatsuaki Nakato, Nate Young |
| amps | 7 | | | |
| pulse width (ms) | 4.5 | | water temperature (F) | 76 |
| # netters | 2 | | | |

**Run 1** - right bank nearshore

| | | |
|---|---|---|
| start time | | 11:30 |
| duration (seconds) | | 1753 |
| begin coords (degrees) | latitude | 41.45296 |
| | longitude | 90.76645 |
| end coords (degrees) | latitude | 41.45318 |
| | longitude | 90.77156 |
| approximate depth range (ft) | | 2 - 5 |

| species | length (in) |
|---|---|
| bluegill | 3.0 |
| channel catfish | 21.1 |
| channel catfish | 19.0 |
| channel catfish | 18.3 |
| channel catfish | 18.1 |
| channel catfish | 17.6 |
| channel catfish | 17.1 |
| channel catfish | 16.9 |
| channel catfish | 16.9 |
| channel catfish | 16.0 |
| channel catfish | 15.5 |
| channel catfish | 15.2 |
| channel catfish | 13.4 |
| channel catfish | 5.0 |
| common carp | 28.4 |
| common carp | 26.0 |
| common carp | 25.2 |
| common carp | 22.5 |
| common carp | 22.5 |
| freshwater drum | 16.5 |
| freshwater drum | 16.1 |
| freshwater drum | 14.9 |
| freshwater drum | 13.5 |
| freshwater drum | 12.5 |
| freshwater drum | 12.3 |
| freshwater drum | 9.0 |
| freshwater drum | 8.0 |
| freshwater drum | 7.8 |
| gizzard shad | 13.7 |
| gizzard shad | 6.0 |
| gizzard shad | 6.0 |
| gizzard shad | 5.9 |
| gizzard shad | 5.6 |
| gizzard shad | 5.5 |
| longnose gar | 23.0 |
| mooneye | 11.3 |
| quillback carpsucker | 14.2 |
| river carp sucker | 15.7 |
| silver redhorse | 20.2 |
| shorthead redhorse | 10.5 |
| silver lamprey | |
| smallmouth buffalo | 15.6 |
| smallmouth buffalo | 15.0 |
| smallmouth buffalo | 10.2 |
| white bass | 10.1 |
| white bass | 10.1 |

**Run 2** - right bank offshore

| | | |
|---|---|---|
| start time | | 12:30 |
| duration (seconds) | | 818 |
| begin coords (degrees) | latitude | 41.45290 |
| | longitude | 90.76341 |
| end coords (degrees) | latitude | 44.45289 |
| | longitude | 90.77155 |
| approximate depth range (ft) | | ~ 5 |

| species | length (in) |
|---|---|
| freshwater drum | 14.2 |
| freshwater drum | 14.0 |
| freshwater drum | 12.8 |
| shorthead redhorse | 19.4 |
| shorthead redhorse | 19.0 |
| shorthead redhorse | 17.9 |
| shorthead redhorse | 17.5 |
| shorthead redhorse | 17.0 |
| shorthead redhorse | 16.8 |
| shorthead redhorse | 16.3 |
| shorthead redhorse | 15.9 |
| shorthead redhorse | 15.8 |
| shorthead redhorse | 15.8 |
| shorthead redhorse | 15.6 |
| shorthead redhorse | 15.5 |
| shorthead redhorse | 15.1 |
| shorthead redhorse | 13.8 |
| shorthead redhorse | 13.2 |
| shorthead redhorse | 12.8 |
| shorthead redhorse | 12.5 |
| shorthead redhorse | 12.4 |
| shorthead redhorse | 12.3 |
| shorthead redhorse | 12.0 |
| shorthead redhorse | 11.8 |
| shorthead redhorse | 11.8 |
| shorthead redhorse | 11.5 |
| shorthead redhorse | 11.5 |
| shorthead redhorse | 10.7 |
| smallmouth buffalo | 18.8 |

Notes:
1. Run 1 included both parallel and perpendicular shocking
2. Run 2 included only parallel shocking

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**Silver lamprey attached to common carp**

**Mouth of silver lamprey (all disc teeth of innermost circle have single point)**

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**Shorthead redhorse captured in Run 1**

**Quillback carpsucker captured in Run 1**

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**Unique internal feature of mooneye captured in Run 1 – say Ahhh**

**Teeth of longnose gar captured in Run 1**

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# Education

***20 May-7 June 2002; 21 May—4 June 2003; and 19 May—2 June 2004: Water Quality*** *Classes offered by Prof. Jerry Schnoor which was attended by 15 students – 3-week long intensive summer course (12:00 noon-5 p.m., 3 times a week), including classroom lectures, field sessions on the Mississippi River, and lab analyses using the Water Quality Lab in LACMRERS.* ***The LACMRERS received a gift of $100,000 from Marie F. Carter, in memory of Archie N. Carter, and $50,000 from Richard and Mary Jo Stanley to furnish the classroom and the Water Quality Laboratory, respectively.***







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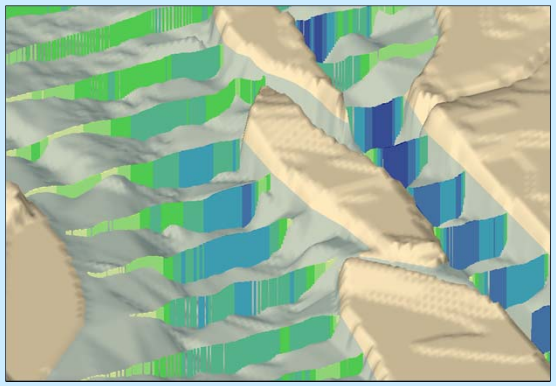
# IIHR Internal Activities

1. Detailed Bathymetry Mapping of Pool 16 -- 20 cross sections every mile: practically completed
2. 3D CFD modeling effort based on the field data
3. Mussel habitat modeling effort



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# *UI – an Equal Partner with the University of Missouri-Colombia*

## *for the Upper & Middle Mississippi Valley Cooperative Ecosystem Studies Unit (CESU)*

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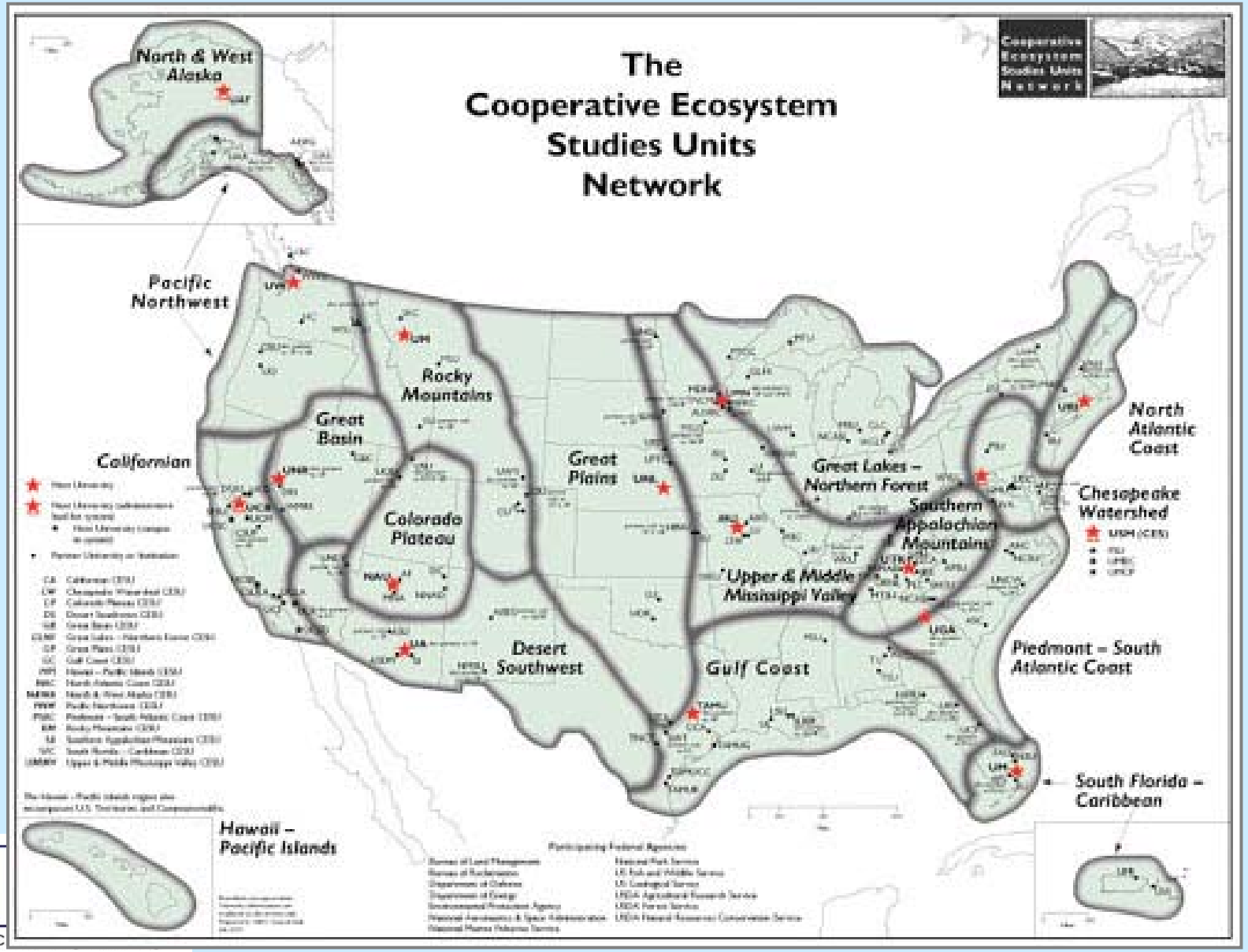
# CESU Network

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# *The objectives of this network are to*

- ***provide resource managers with high-quality scientific research, technical assistance, and education;***
- ***deliver research and technical assistance that is timely, relevant to resource managers, and needed to develop and implement sound adaptive management approaches;***
- ***ensure the independence and objectivity of research;***
- ***create and maintain effective partnerships among federal agencies and universities to share resources and expertise;***
- ***take full advantage of university resources while benefiting faculty and students;***
- ***encourage professional development of federal scientists; and***
- ***manage federal science resources efficiently.***

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# *Key elements of each CESU include*

***1) multiple federal agencies,***
***2) a host university,***
***3) partner institutions,***
***4) a role and mission statement,***
***5) a manager's committee, and***
***6) strategic and annual work plans.***

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# *PARTNERS*

- ***University of Missouri (Host)***
- ***Drake / Indiana / Iowa State / Lincoln / Southern Illinois University / Southwest Missouri State / U of Illinois / University of Iowa / University of Kansas / University of Minnesota / Audubon Missouri / Audubon-Upper Mississippi River Campaign / Conservation Federation of Missouri / Missouri Botanical Garden / Missouri Department of Natural Resources / National Mississippi River Museum and Aquarium***

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# *FEDERAL AGENCIES INVOLVED*

- ***Bureau of Land Management***
- ***USGS Biological Resources Division***
- ***National Park Service***
- ***US Army Corps of Engineers***
- ***Natural Resources Conservation Service (formerly Soil Conservation Service)***

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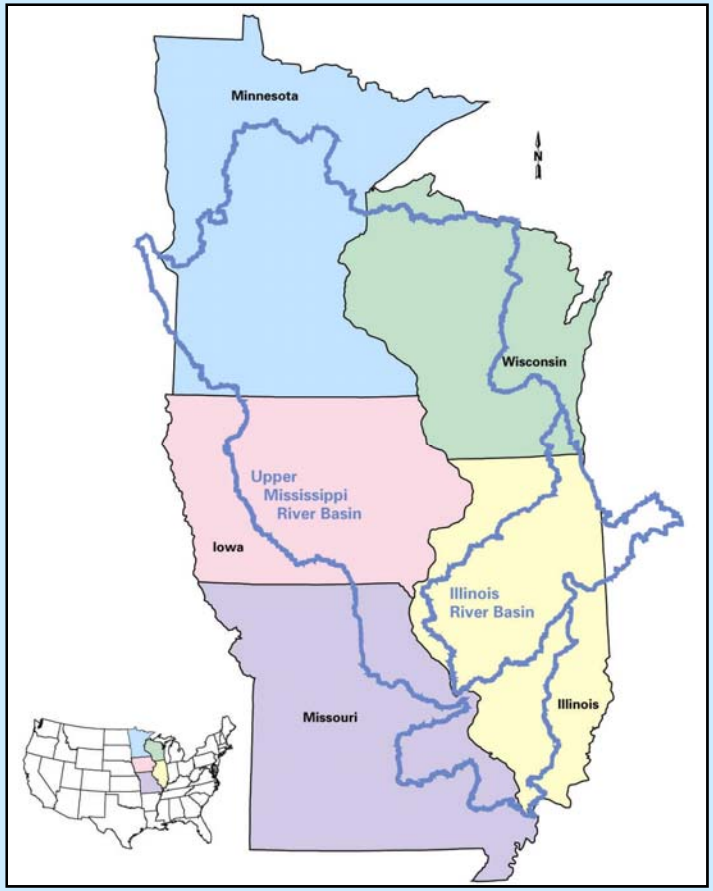
# *Supplement on UMR*

# The Mississippi River

- *The MR trickles from Lake Itaska and empties into the Gulf of Mexico, 2,350 miles (3,710 km) later*
- *The Upper MR extend from St. Paul, MN to Cairo, IL, 870 mi (~1,400 km)*
- *The UMR basin is about 190,000 mi² (~491,900 km²)*

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# *The Upper Mississippi River*

- ***There are 485 species of fish, mussels, birds, mammals, amphibians, and reptiles***
- ***29 lock & dam installations***
- ***126 million tons of cargo a year on the UMR alone***

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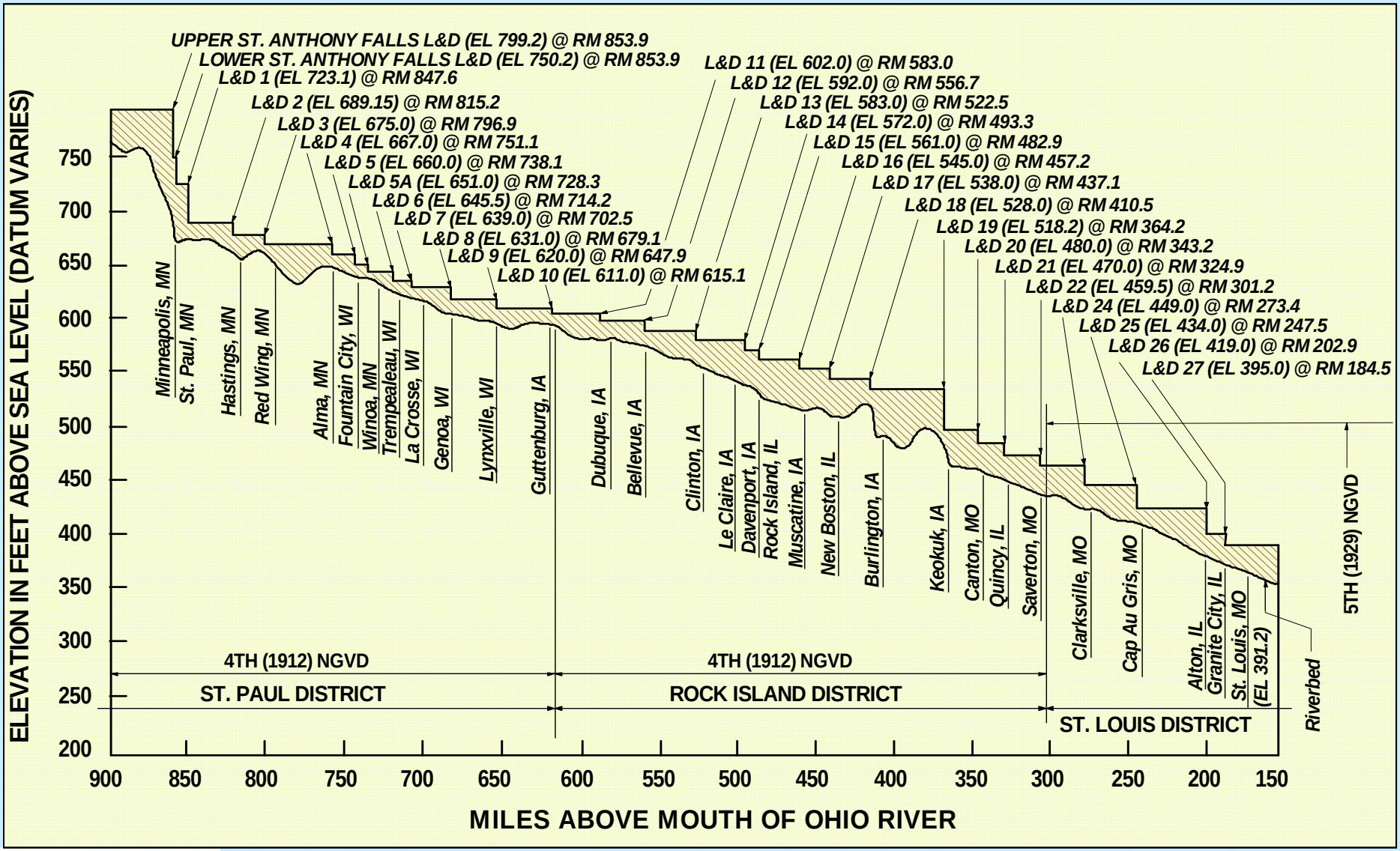
# UMR L&D System

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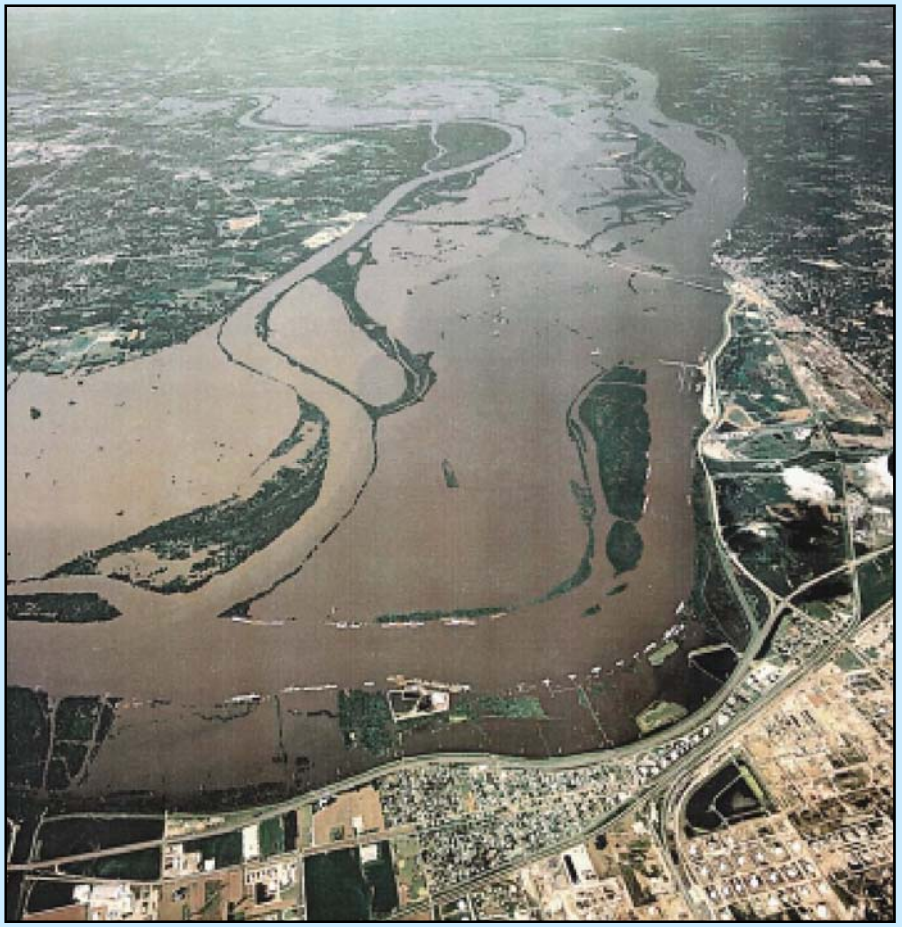
*Quiescent Mississippi River*



*Flooded Mississippi River/Missouri River Confluence during Flood of '93*

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**Flooded MR / MR Confluence during Flood of '93**


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***The Great Flood of '93: Canton, MO***

***The Great Flood of '93: Dubuque Street next to Mayflower Apartment***

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# Raging Iowa River below Burlington Bridge (7/16/93)

Quiet Iowa River below Burlington Bridge (7/16/94)

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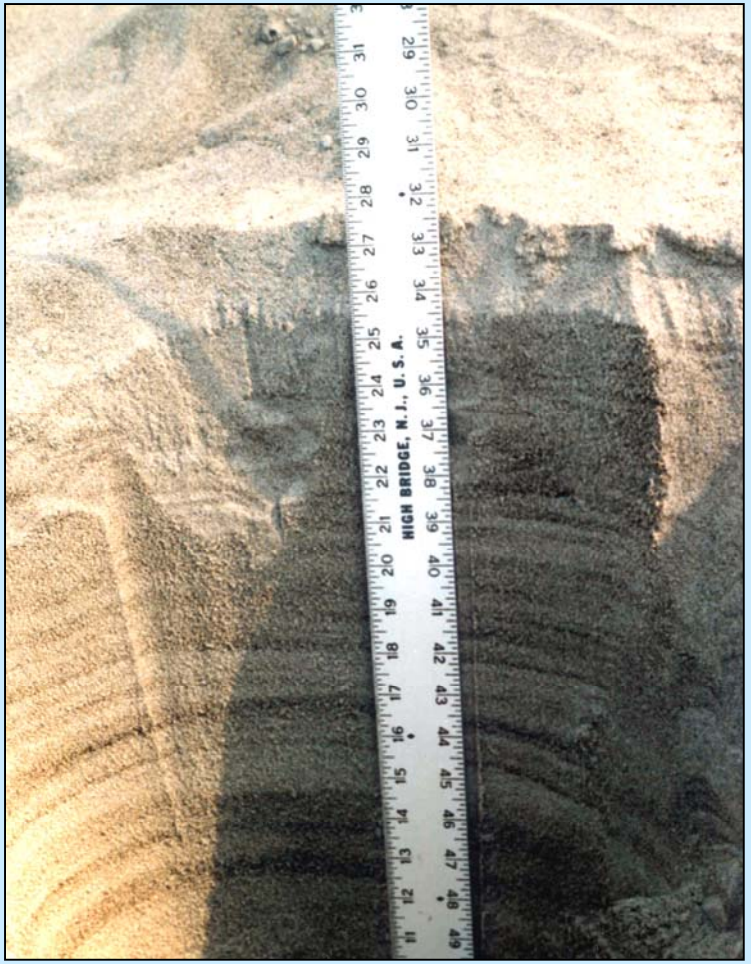
# *Sand Dunes Appeared in City Park – Vertical Face Shows the History of Flood Sequence (10/6/93)*

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