



Our Mission...

*...to preserve the plants, animals,
and natural communities that
represent the diversity of life on
Earth by protecting the lands and
waters they need to survive.*

Once the most productive mussel streams per mile in North America





History of Mussel Propagation on the UMR

The first propagation projects date back to the early 1900's with mussel industry attempts to supplement populations of commercially harvested species.

Zebra mussels, an exotic species, posed a significant threat to freshwater mussels by competing for food, habitat degradation, and impairing reproduction and recruitment. They were introduced to the UMR in the early 1990's.

Decline in Higgins eye numbers (abundance and recruitment) facilitated the rebirth of mussel propagation in 2000. A mussel culture facility was constructed at the Genoa National Fish Hatchery in Wisconsin and efforts to date have seen some success.

A protocol was developed for collecting gravid female mussels, and inoculating their host fish with glochidia



Early Mussel Conservation Milestones

2005 Status of Implementation of Higgins Eye Pearlymussel (*Lampsilis higginsii*) Reasonable and Prudent Alternatives and Reasonable and Prudent Measures, and Winged Mapleleaf (*Quadrula fragosa*) Reasonable and Prudent Measures UASCOE

2004 Final Biological Opinion for the Upper Mississippi River-Illinois Waterway System Navigation Feasibility Study U.S.F.W.S
Conservation Plan for Freshwater Mussels of the Upper Mississippi River System UMR Conservation Committee's ad hoc mussel committee
Plan for Controlled Propagation, Augmentation, and Reintroduction of Winged Mapleleaf (*Quadrula fragosa*) Mussel Coordination Team focused on implementation
Winged Mapleleaf Mussel Early Life History Investigations was Conducted by the U.S. Department of the Interior in FY2004

2003 Plan for Controlled Propagation, Augmentation, and Reintroduction of Winged Mapleleaf (*Quadrula fragosa*) Mussel Coordination Team started implementation
Mississippi River Between the Missouri River and Minneapolis, 9-Foot Channel Project Measures for Managing Zebra Mussels – Reconnaissance Report Corps

2002 Definite Project Report and Environmental Assessment for Relocation Plan for the Endangered Higgins' Eye Pearlymussel (*Lampsilis higginsii*), Upper Mississippi river and Tributaries, Minnesota, Wisconsin, Iowa and Illinois, USACOE
Saving the Higgins' Eye Pearlymussel (*Lampsilis higginsii*) from Extinction: 2002 Status Report on the Accomplishments of the Mussel Coordination Team

2001 A Call for Actions Needed to Help Prevent the Extinction of Mussels on the Upper Mississippi River System: Saving the Federally-Endangered Higgins' Eye Pearly Mussel (*Lampsilis higginsii*) and Endangered Winged Mapleleaf Mussel (*Quadrula fragosa*) USFWS

2000 Corps of Engineers established interagency **Mussel Conservation Team** to implement requirements to avoid jeopardy to Higgins' eye. The USFWS completed a Biological Opinion for UMR

1995-97 National Mussel Conservation Committee is formed
National Strategy for the Conservation of Native Freshwater Mussels published

1989 A Recovery plan for the Fat Pocketbook was completed

1988 A Strategic Plan the the Management of Freshwater Mussel Resource of the Upper Mississippi River UMR Conservation committee

1982 Higgins' Eye Mussel Recovery Plan completed USFWS



Species propagated on the UMR

Butterfly

Higgins' Eye

Black Sandshell

Hickorynut

Plain Pocketbook

Salamander

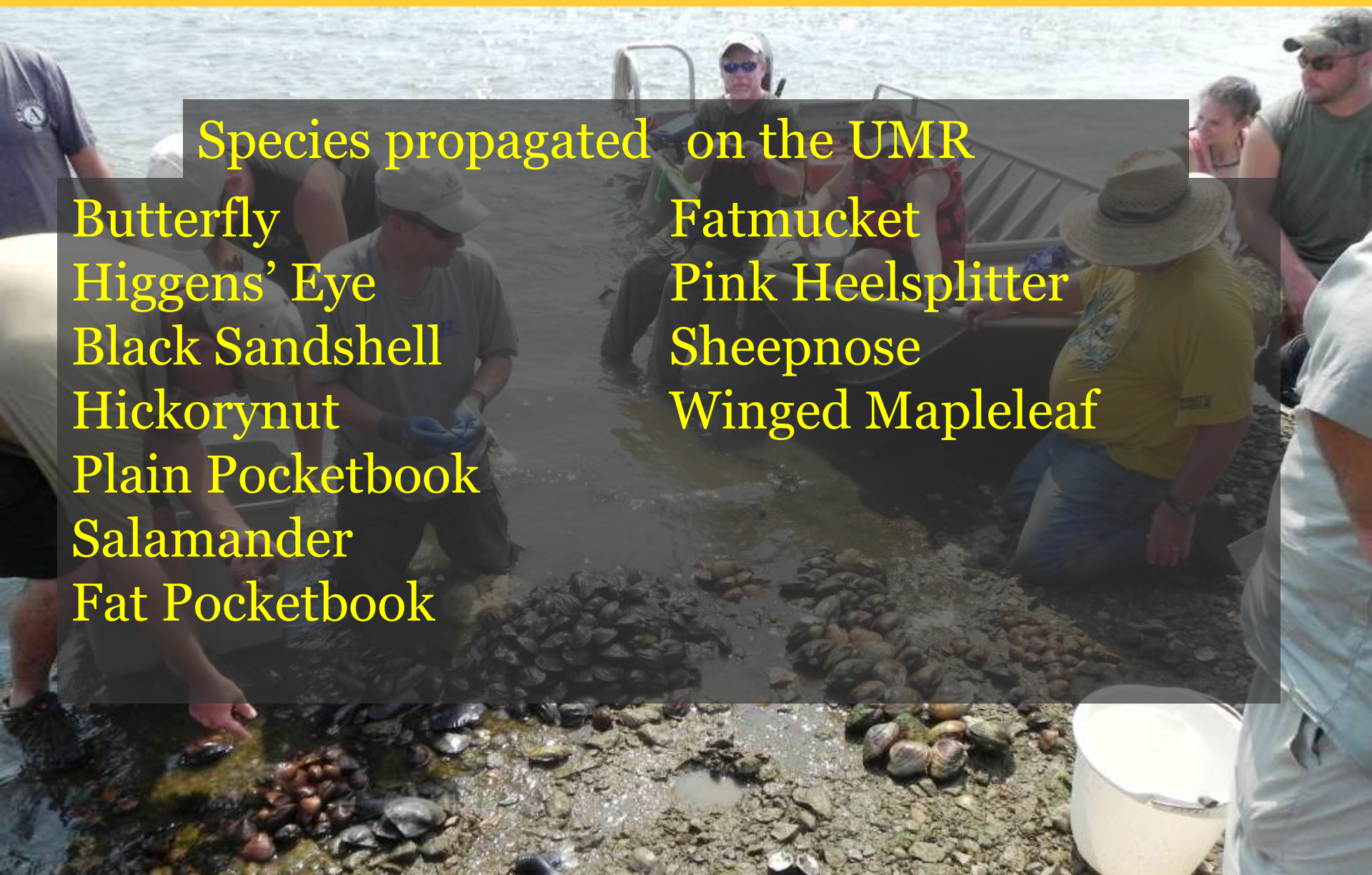
Fat Pocketbook

Fatmucket

Pink Heelsplitter

Sheepnose

Winged Mapleleaf





Higgins' eye

Cage Survey

Location	# cages surveyed (total cages)	# recovered / cage
L/D 7 Spillway	2(27)	0
La Crescent	1(30)	0
Dubuque	10(10)	173
Houlton	0(45)	--
Total (4)	13(112)	1,730



Developing a culturing technique for native Illinois River CWCP mussels

By Tharran Hobson
IL River Restoration Manager





The project was initiated by applying for and received a state wildlife grant through IDNR.

The purpose of this project is to test propagation techniques for captive rearing of the butterfly mussel, a species of conservation concern as listed in the Wildlife Action Plan.





TNC adapted propagation techniques developed for Higgins Eye mussel recovery on the Mississippi River

- **The objectives of the project:**
- **Investigate the suitability of Spunky Bottoms for Butterfly Mussel propagation**
- **Collect gravid female mussels from the Mississippi River**
- **Propagate mussels with host fish using two water quality treatments, in ten cages at Spunky Bottoms**
- **Monitor and compare treatments of propagated mussels at the project site**



The Merwin Preserve (TNC) at Spunky Bottoms

- **1,197 acres**
- **Isolated backwater of the IL River**

Weinberg-King satellite site (IDNR) at Spunky Bottoms

- **833 acres**

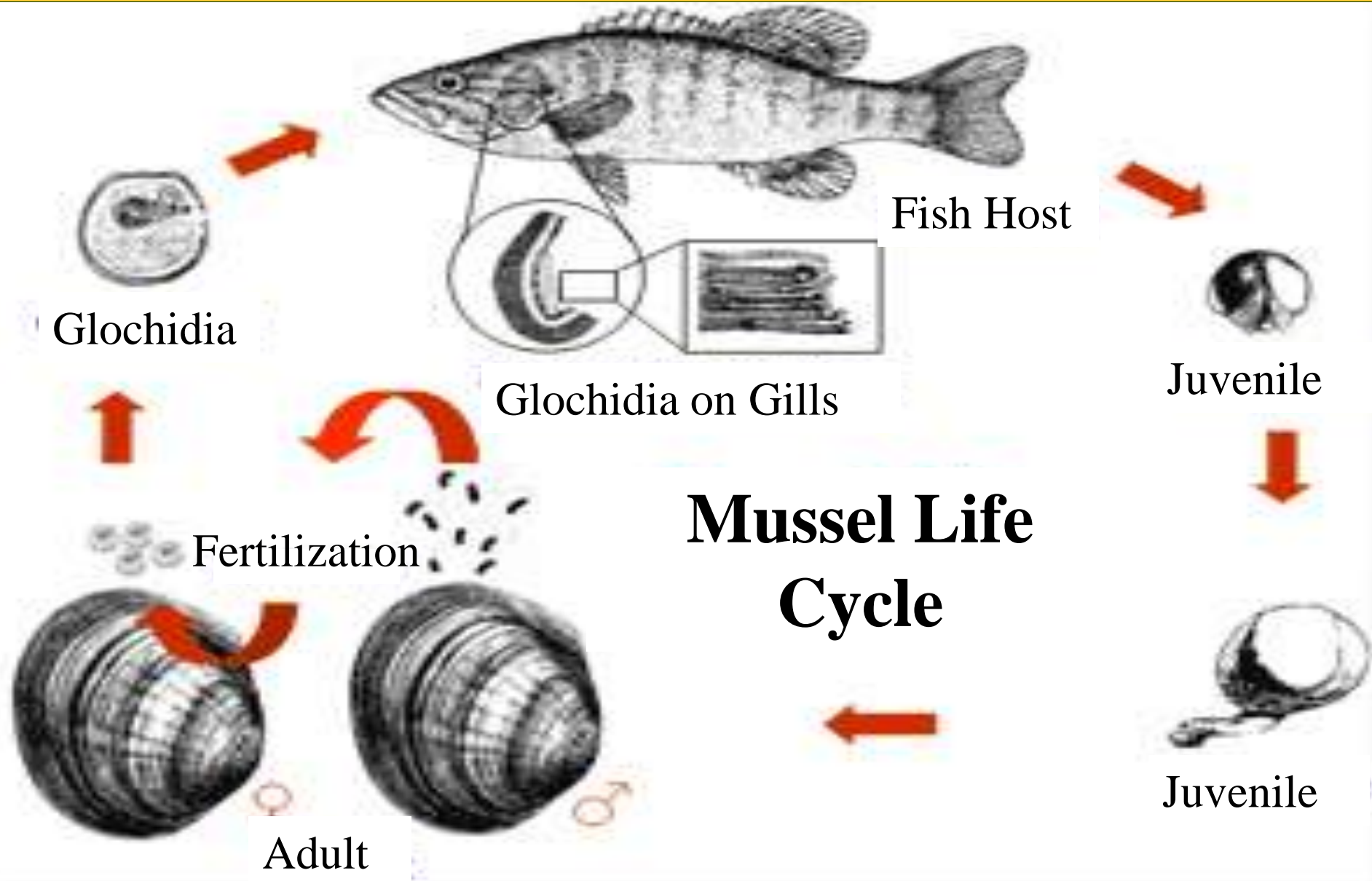
Emiquon Preserve (TNC)

- **6,800 acres**
- **Isolated floodplain restoration**



The butterfly mussel *Ellipsaria lineolata*

- Was once relatively abundant in the IL River (surveys from 1870-1912)
- Most recent survey records recorded only 2 individuals. One located near Grafton, IL (river mile 5) and one near Montezuma, IL (river mile 40) (Whitney et al, 1997)
- Interviews with resource professionals and literature review indicate no viable populations remaining on the IL River





Mussel Cage Construction



Cages were built in July 08 with help from IDNR

Each rack contains five 2'X3'X2' enclosures

Enclosure contains a 2-3" sand substrate

Cage arrays were strategically placed in two different locations at Spunky

An aerator was placed near one of the cage arrays

A YSI sonde measuring DO, temperature, PH and conductivity was placed on each array taking





Host Fish Collection (April 2009)

Freshwater drum are a known host for the butterfly mussel.

Rob Hilsabeck (IDNR) aided in collection of healthy, moderately sized, adult drum.

The drum were collected on the IL River and taken directly to Jake Wolf State Fish Hatchery.

There they were closely monitored and treated with a 1% salt solution occasionally.



April 2009
Tony Brady (USFWS)
extracts glochidia and
infects the hosts.





The inoculated drum, as well as some inoculated walleye with black sandshell remained at Jake Wolf until glochidial transformation approached. There was some concern for drum survivability. Walleye inoculated with black sand shell were added to the experiment to test their tolerance to the environment.



- Glochidial transformation was estimated to take place at approximately 350-400 degree days.
- Calculating degree days is a method for tracking transformation periods for mussel glochidia

Degree days are calculated by compounding daily water temps that exceed 50 degrees Fahrenheit

ex. 54 degrees Fahrenheit (day 1) = 4 degree days

54 degrees Fahrenheit (day 2) = 8 degree days

60 degrees Fahrenheit (day 3) = 18 degree days



fish to Spunky

- The drum and walleye were transported the first week of May
- Fish were placed in enclosures and careful record was taken of the number of fish and species in each enclosure
- Drum and walleye were retained separately
- Water quality measurements were continuously taken
- The fish remained in the enclosures until glochidial transformation tracking reached 780 degree days (May 27)





Fish resilience was better than expected with the loss of only 5 of 22 drum and 0 of 33 walleye losses.

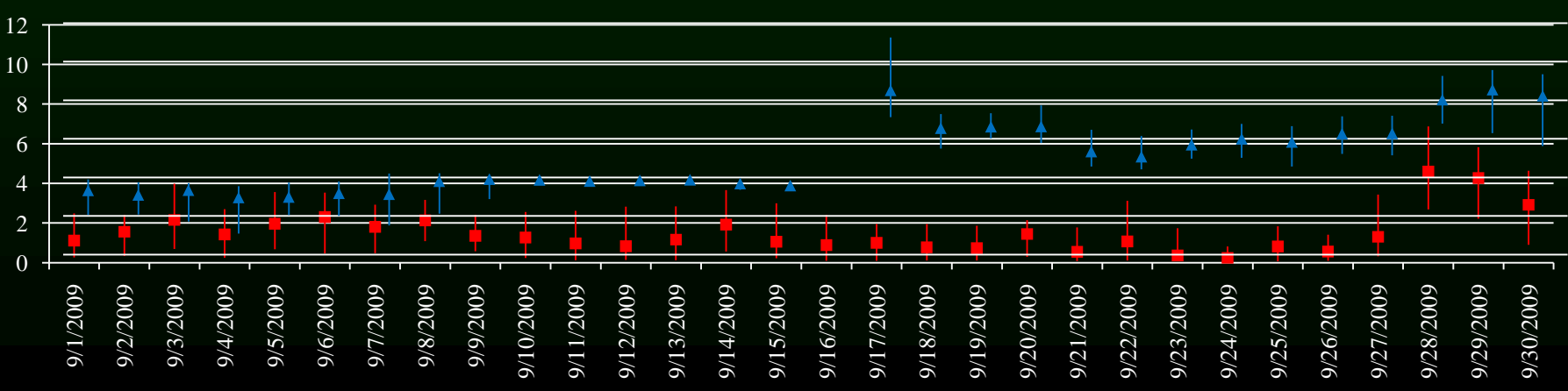
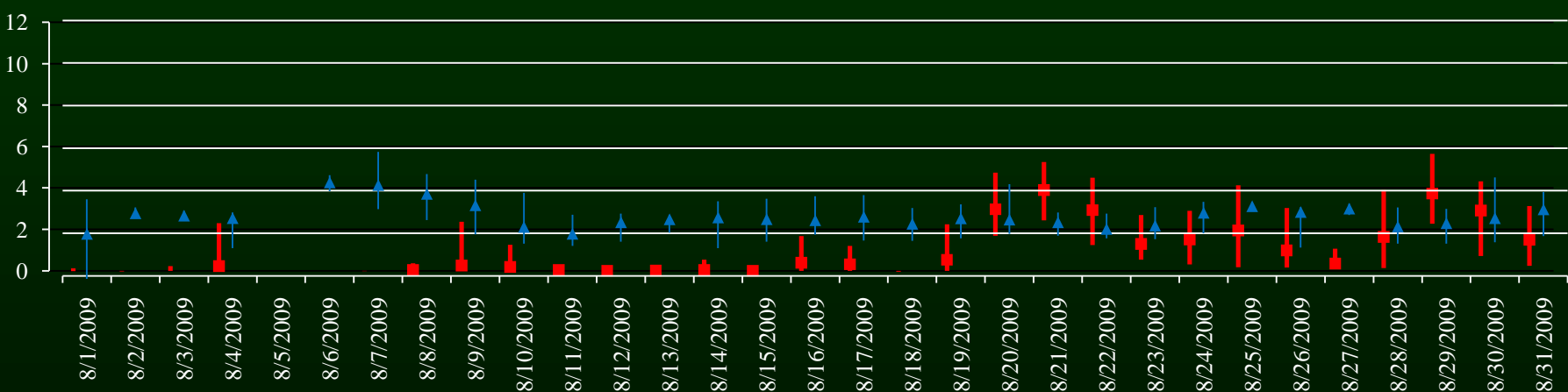
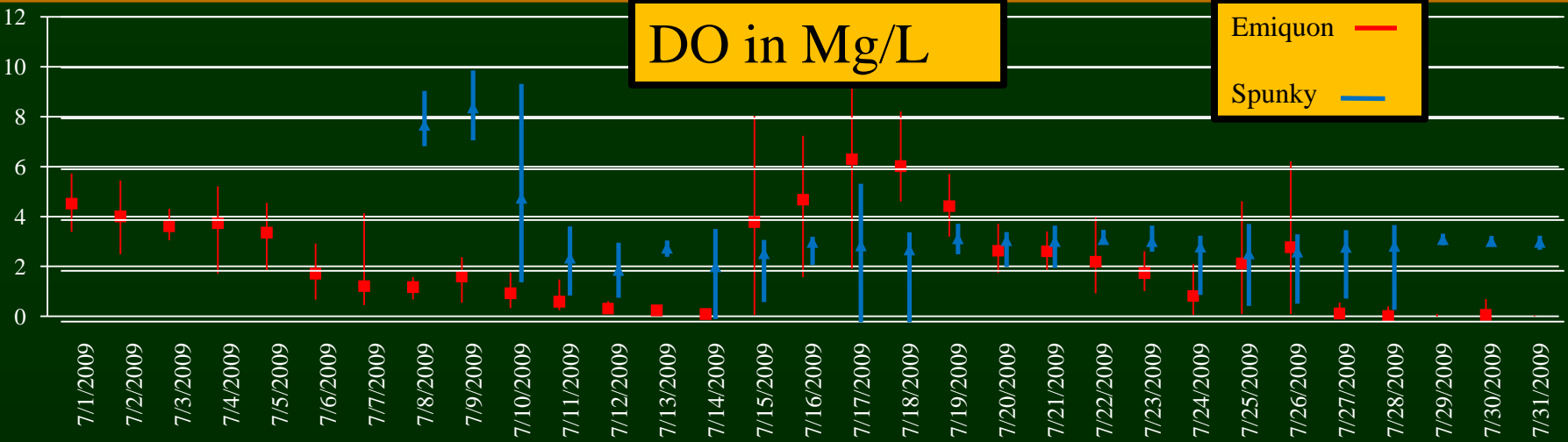
This was due to careful collection, TLC at the hatchery, and cool temperatures with reasonable DO levels at Spunky.

Drum were lost at both the aerated and unaerated arrays.

All the fish were removed and the drum were released back to the IL River.

DO in Mg/L

Emiquon —
Spunky —





The enclosures were undisturbed until October 6th

The mussels were expected to have reached ~5 mm. (visible to the naked eye) in size and buried in the substrate of the enclosures.

A crew of professionals from IDNR, USFWS and TNC pulled all the enclosures and sampled their contents by sieving the substrate through a multi-grade sieve.





Results

We found no transformed butterfly or black sandshell mussels

Potential cause :

There was 50-70 mm of flocculent sediment on substrate in enclosures

Water quality data showed extreme turbid conditions for the summer months

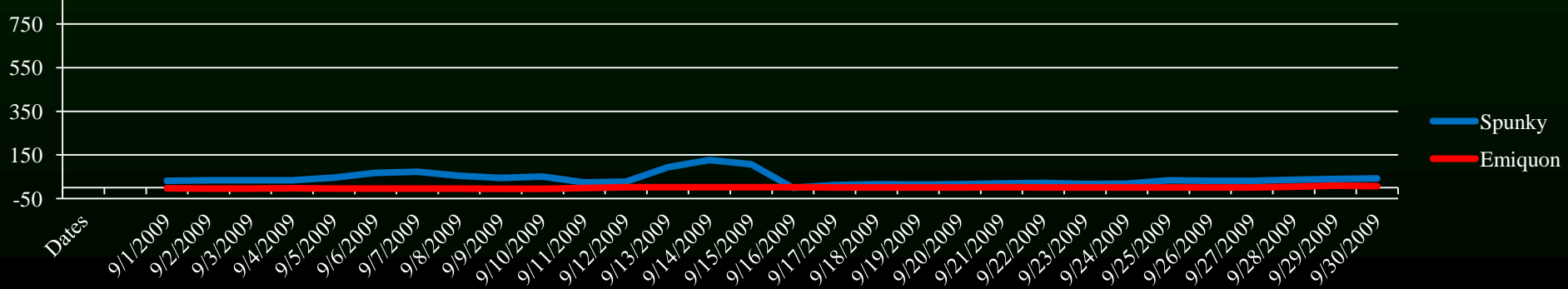
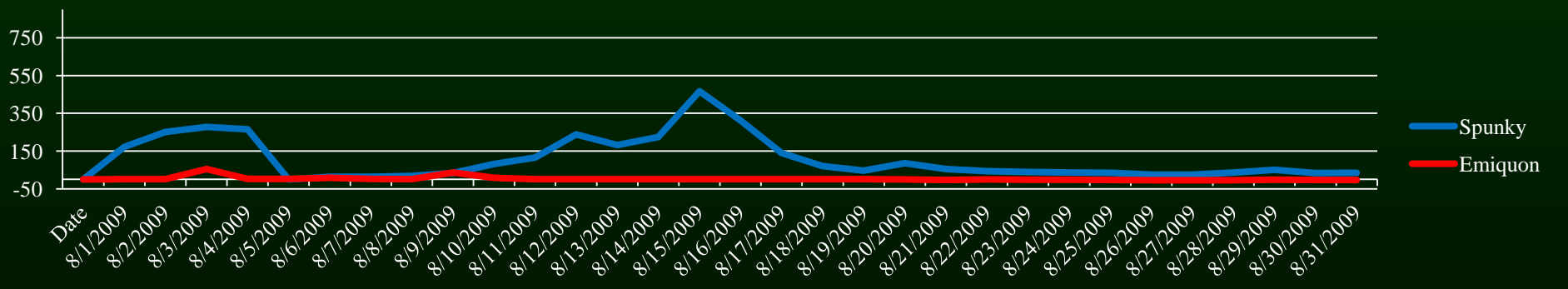
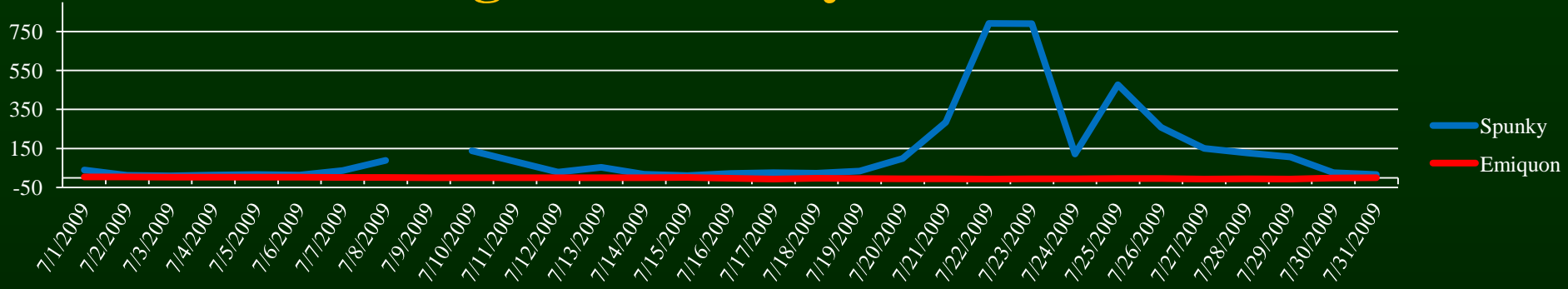
In Preliminary analysis, Susan Meiers (WIU, phycology) did not find any reason to believe the lack of mussel production was due to harmful algae.

Preliminary hypothesis indicates the glochidia dropped off of the fish into the sediments and were suffocated in early development.

High levels of organic and inorganic suspended sediments could be due to the abundance of rainfall and subsequent runoff.



Avg. of Turbidity in NTU





Upcoming Project Strategies

- We will attempt this project again with a few strategic changes if conditions allow us to collect the mussels and fish again.
- We will eliminate aeration in the cage array.
- We will move one of the cage arrays to Emiquon; Emiquon appears to have more stable water quality conditions. The other cage array will stay at Spunky.



Current Strategies

- We eliminated the aeration in the cage array
- We collected butterfly mussels from the Mississippi River near Fairport IA Sept 1, 2011
- Mixed sex brood stock to be over-wintered at a secure location.
- We chose to put all the mussels at Emiquon due to its more stable water quality conditions and put them in an area where sedimentation is not problematic.



Mussel cage at Emiquon Preserve, Fulton county, Illinois





Spring 2012 Strategy

- Brood stock mussels to be transported to Genoa National Fish Hatchery
- Host fish inoculation
- Transport host fish to Emiquon and Spunky
- Raise juvenile mussels to sub-adult
- Transfer mussels to Alton Pool bed







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