Endangered Freshwater Mussels and Bridge Construction: Proactive Planning to Streamline the Regulatory Process

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Regulatory Process

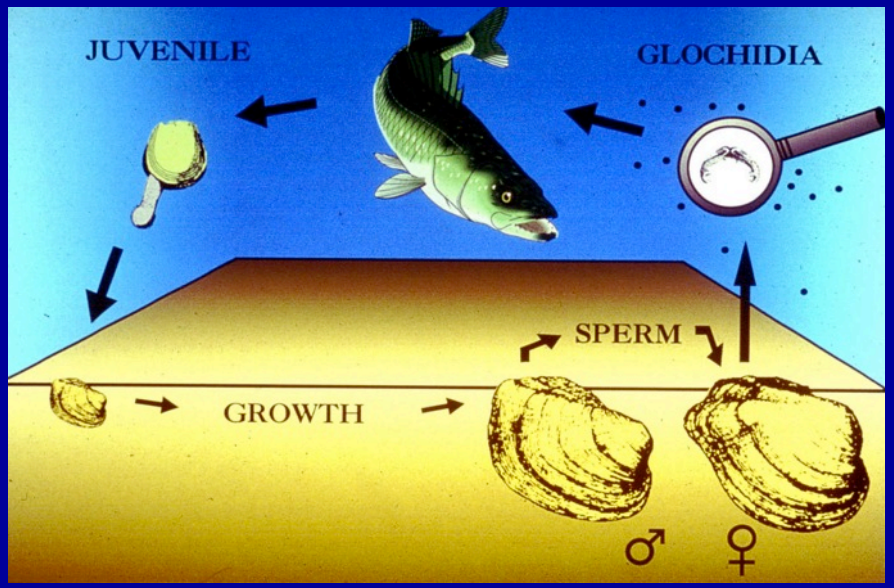
Coordination with U.S. Fish & Wildlife Service to protect federal endangered species under Section 7 of the Endangered Species Act

Missouri Wildlife Code prohibits take of Missouri endangered species – coordination with Missouri Department of Conservation

Freshwater Mussels

- Native bivalves in Order Unionoida/Unionida
- Evolved to live in freshwater riverine ecosystems
  - Hydrological cycle (floods/droughts)
  - Local hydraulic conditions (flow refugia, bed stability)
  - Presence indicative of functioning river system
- Unique life cycle (use of fish host)

Unique Life Cycle



Male releases sperm balls

Female takes up sperm balls

Fertilized eggs develop in gills

Eggs develop into glochidia

(larval unionid mussels)

Glochidia attach to fish host

Metamorphosis on fish host

Juvenile drops off

Very Alluring

Snuffbox snaring a log perch

Ouachita Kidneyshell conglutinates

Orange nacre mucket super-conglutinate

Lampsilis mussel mantle flap

Barnhart, M. C. 2008. Unio Gallery: http://unionid.missouristate.edu.

What are they good for?

- Cultural heritage
  - Food
  - Shell tools
  - Beads
  - Pearls
  - Pottery

- Pearl Button Industry (late 1800s to early 1950s)
- Cultured pearl industry (mid 1950s – present)

Ecosystem Services

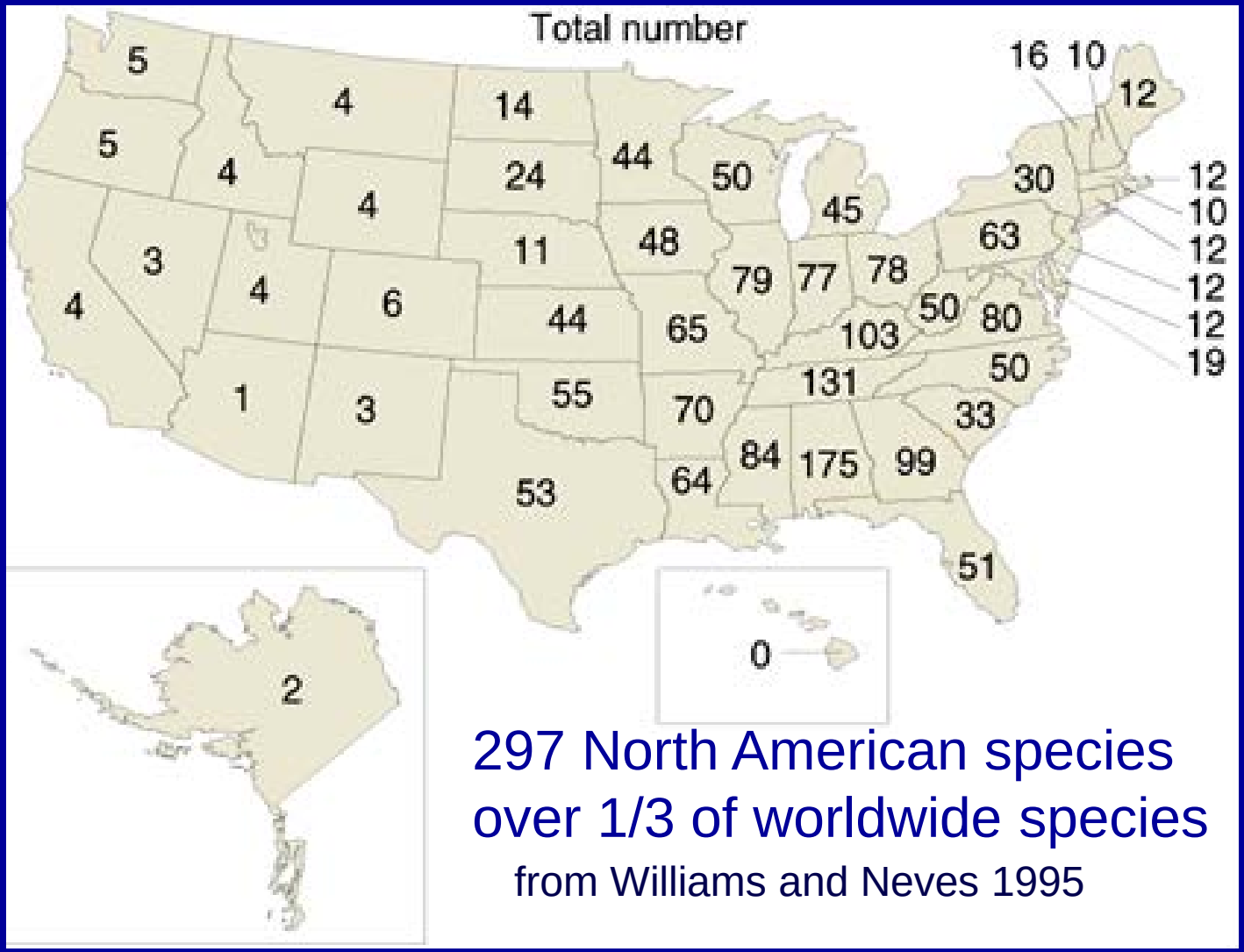
Supporting Services

- Structural habitat
  -cover for fish
  -substrate for algae, insects, snails
  -attract fish
- Substrate modification – aeration, stability
- Food for other organisms

Water purification services

Nutrient cycling

Unionoida Distribution in USA



297 North American species
over 1/3 of worldwide species

from Williams and Neves 1995

Very Endangered

United States

- About 297 species
- 21 Extinct since 1900
- 88 Federally threatened or endangered
- 70% of fauna imperiled

Male and Female Scaleshell

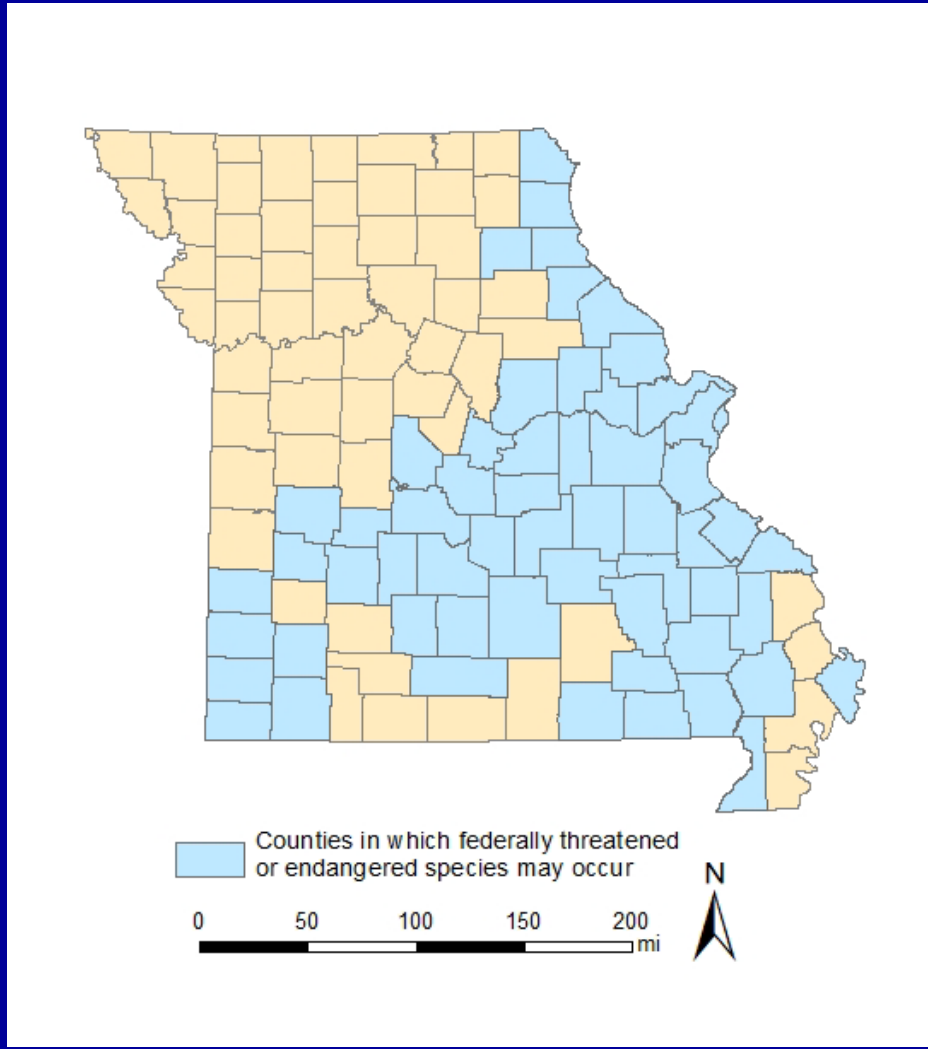
Male Higgins Eye Pearly mussel

Most states also have Unionoida listed as threatened and endangered

Endangered Mussels in Missouri

11 federally threatened or endangered species

4 additional species listed as endangered in MO



Why so endangered?

Habitat loss – modification of rivers/streams

Poor water quality

Sedimentation – siltation

Commercial harvest

Invasive species –
Zebra mussels, Asian clams

What are we losing?

Unique animals
- What other animals can fish?
- Produce pearls

Biodiversity

River's natural filtering system – increased stream clarity

Habitat for plants and animals – increased fish and fishing

Stream/river stability

Tourism and recreational opportunities

Construction and Mussels

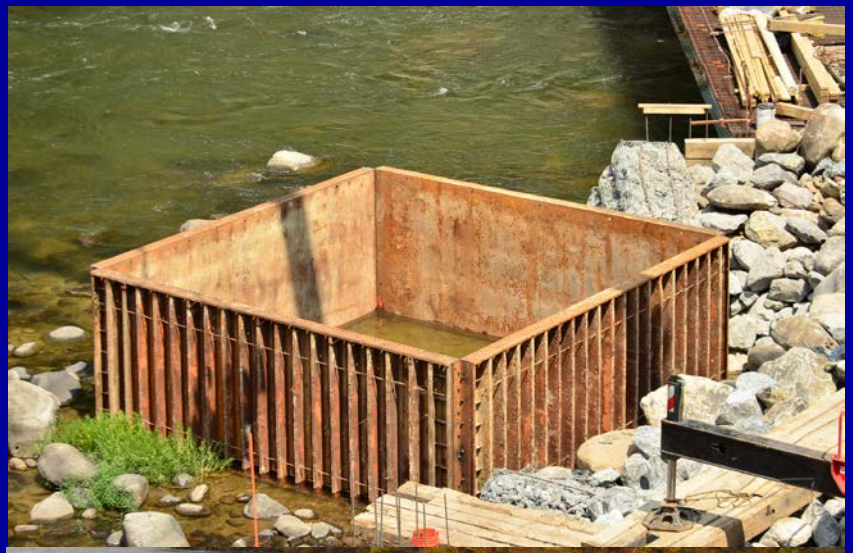
Any instream construction can affect freshwater mussel habitat

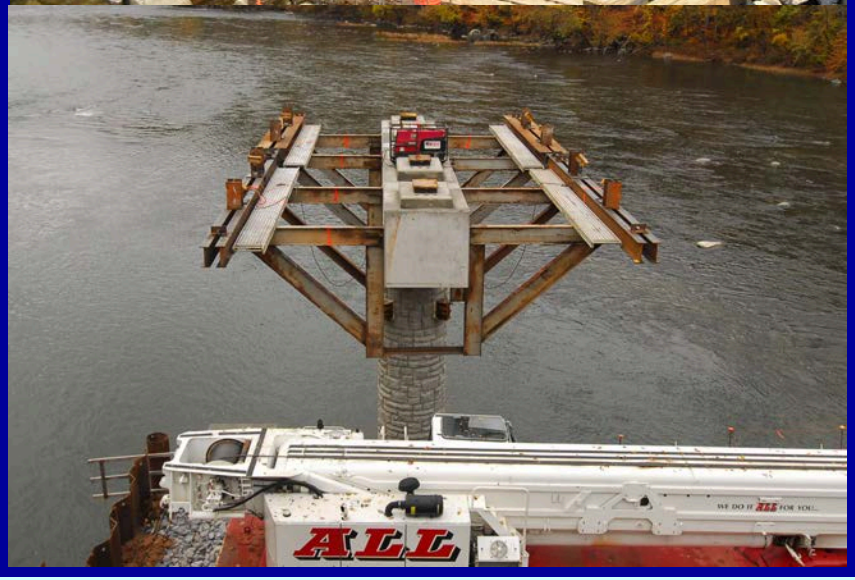
Direct impacts to substrate and river bottom

Changes in local hydraulics

- During construction
- Permanent changes

Construction and Mussels





Effects to habitat and mussels

Construction

- Piers
- Causeways
- Coffer dams
- Staging areas
- Bank revetment
- Clearing riparian areas
- Dredging

Permanent impacts

- Hydraulic changes (piers)
- Modified substrate around piers and in dredged areas
- Causeway removal

Construction and Mussels

In many cases, the need for a mussel survey is not realized until late in the process

Problems encountered

- Project delays
  - Preparation of Biological Assessments
  - Lengthy informal/formal consultation process
- Difficulty changing design to avoid/minimize impacts

Impacts can be avoided if distribution of mussels and habitat known early in the process

Mussel Surveys

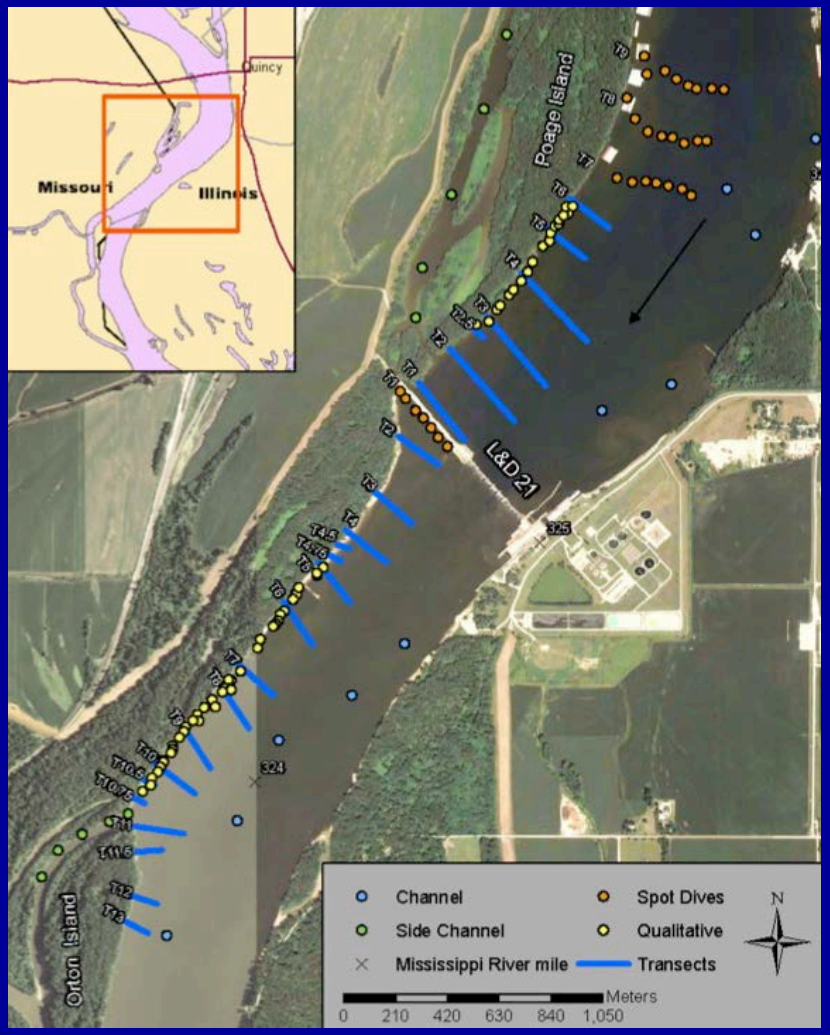
Survey objectives

- Determine distribution of mussels and habitat
    - Include alternatives, if known
    - Upstream/downstream buffers (indirect impacts)
- Estimate take of endangered species

Survey Methods

Semi-quantitative sampling

- Search a fixed area
  - Transect line (larger rivers)
  - Grid cells (smaller streams)
- Map animal/habitat distribution



Survey Methods

Qualitative sampling

- Free search (usually timed)
- Collect as many individuals/species as possible
  - Detect rare/endangered species
- Delineate areas with mussels

Survey Methods

Quantitative sampling

- Collect all animals in small area (0.25 m^2)
- Density and population estimates
- Community metrics
- Estimate Take

Combination of Techniques

Semi-quantitative

- Determine distribution of mussels/habitat

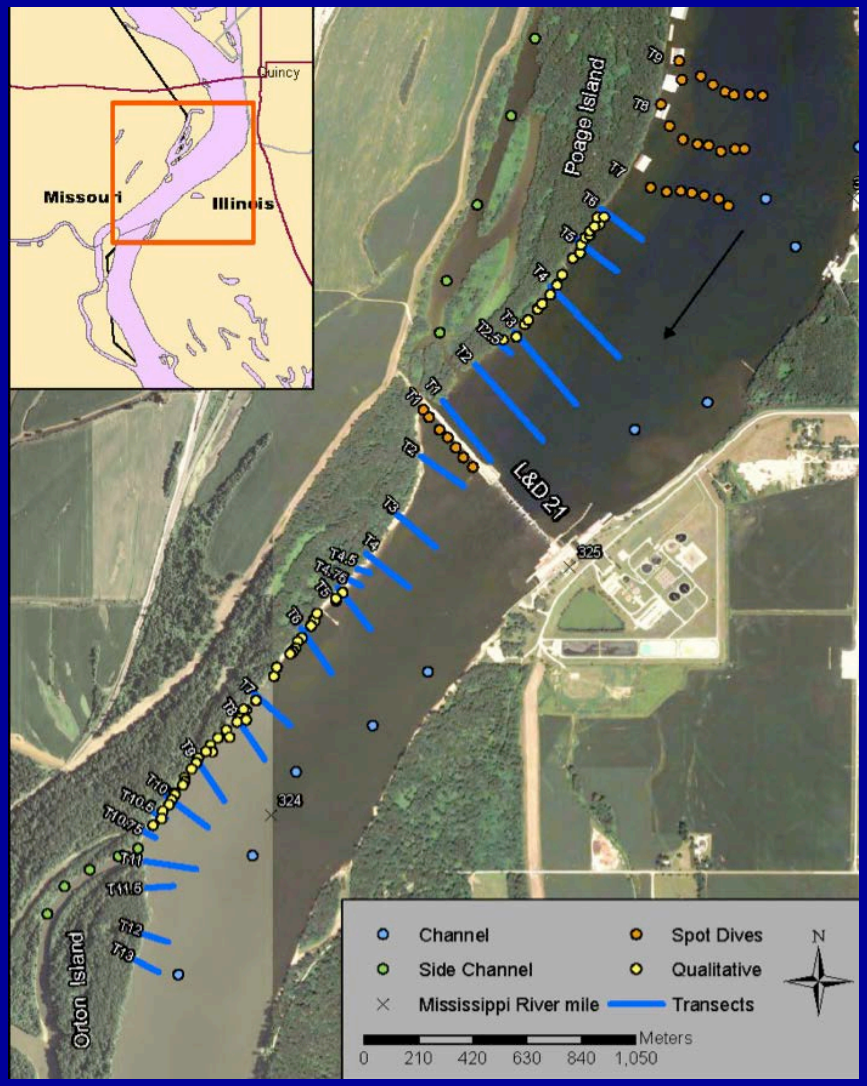
Qualitative

- Refine estimate of mussel bed edges
- Estimate species richness
- Detect rare species

Quantitative

- Random 0.25-m^2 samples in mussel bed to determine community metrics, density, take estimates

Avoid impacts by planning around mussels



Consultation Process

Informal Consultation

- Early stages of planning
- Discuss potential effects of alternatives on endangered species
  - Avoid
  - Minimize
  - Mitigate

Project not likely to adversely affect endangered species

- Consultation is complete

Consultation Process

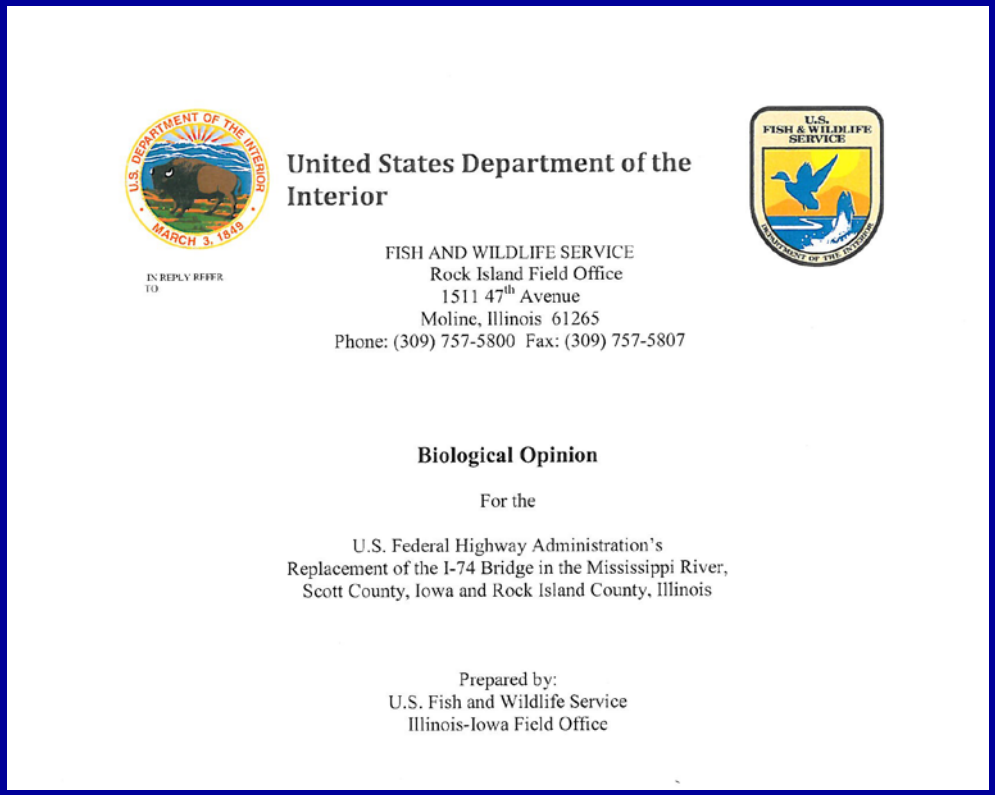
Project may affect endangered species

- Prepare Biological Assessment

Project likely to adversely affect endangered species: initiate formal consultation

- May last up to 90 days
- USFWS issues Biological Opinion
  - 45 days after formal consultation is complete

Consultation process can take several months



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rock Island Field Office
1511 47th Avenue
Moline, Illinois 61265
Phone: (309) 757-5800 Fax: (309) 757-5807

IN REPLY REFER TO

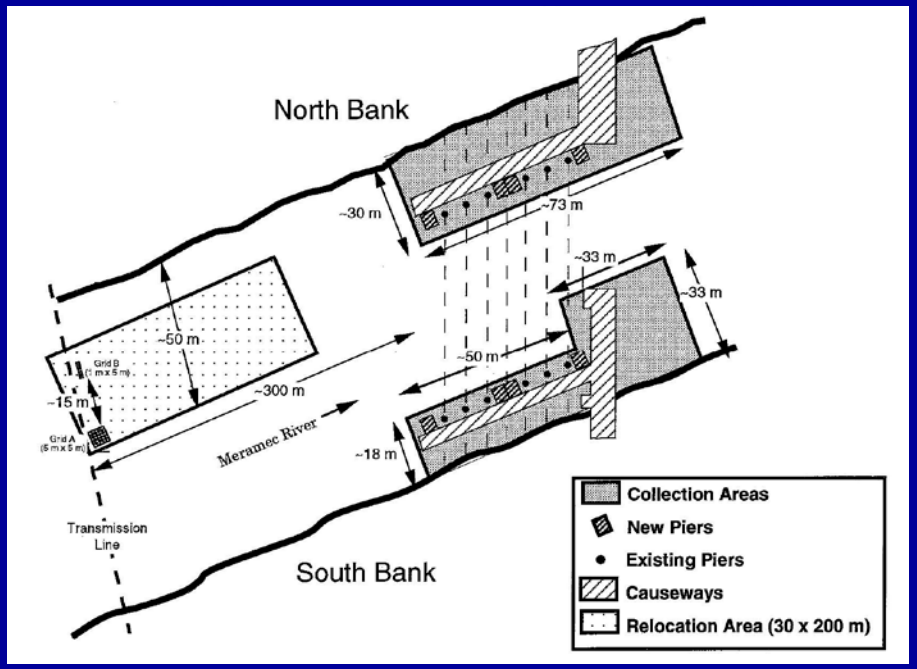
Biological Opinion

For the

U.S. Federal Highway Administration's
Replacement of the I-74 Bridge in the Mississippi River,
Scott County, Iowa and Rock Island County, Illinois

Prepared by:
U.S. Fish and Wildlife Service
Illinois-Iowa Field Office

Project Examples



I-55 bridge, Meramec River (1993)

No pre-construction survey

Contractor delayed until survey was conducted and mussels were relocated

MODOT had to pay contractor for delay

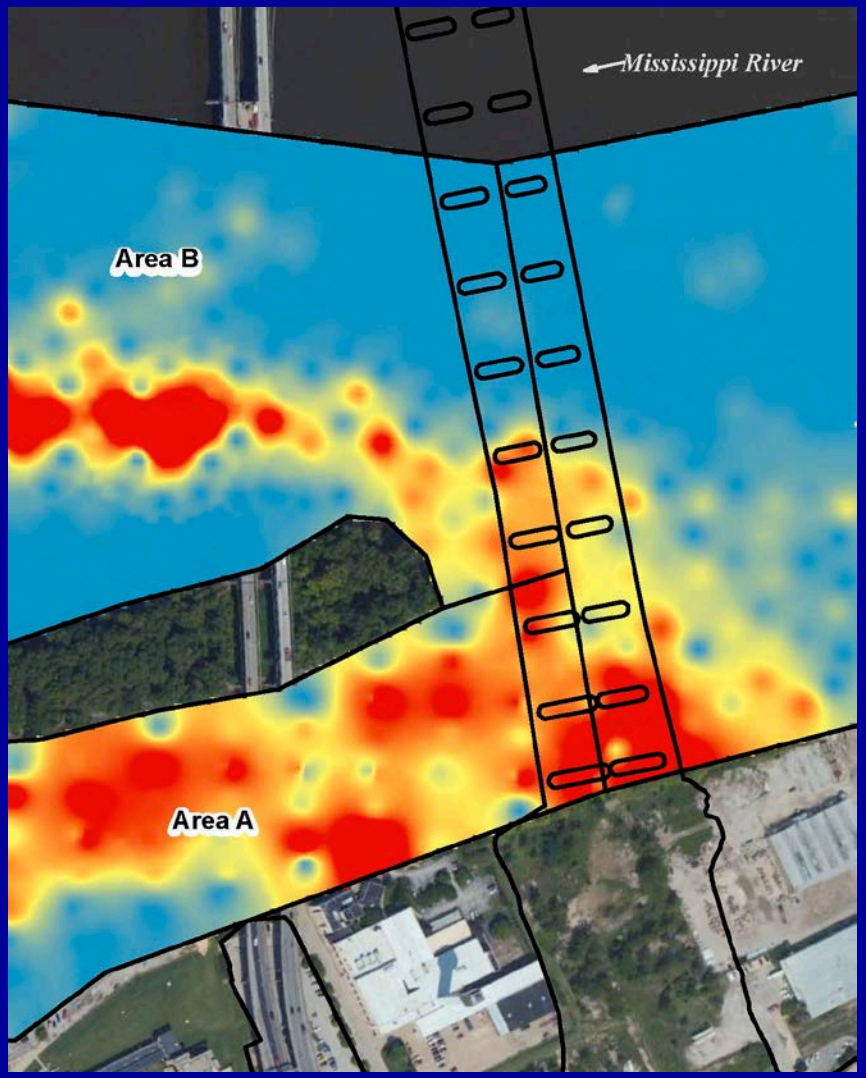
Project Examples

I-74 bridge, Mississippi River (2014+)

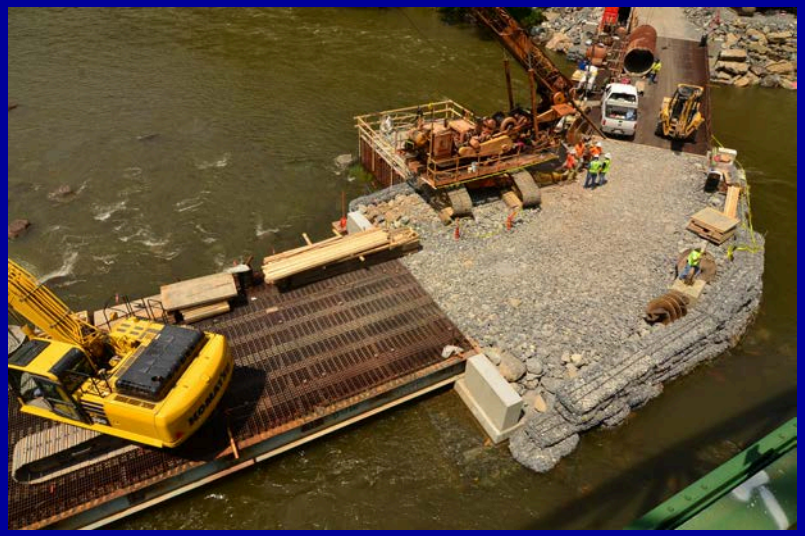
Bridge alignment selected before conducting mussel survey

3 federally endangered species present

>$1M for mussel relocation and mitigation



Project Examples



Thomas Buford Pugh bridge, New River (2013+)

No federal endangered species, but example of good practices

Mussels relocated before construction

Gabion basket causeways – preserve habitat, allow recolonization

Project Examples

Bend Road Bridge, Meramec River, Pacific, MO, (2014 – 2015)

Two mussel beds located and three federal endangered species: scaleshell, sheepnose, and spectaclecase

Alignment chose to minimize impacts

Mussels relocated from new pier footprints

Old pier left in place to preserve habitat

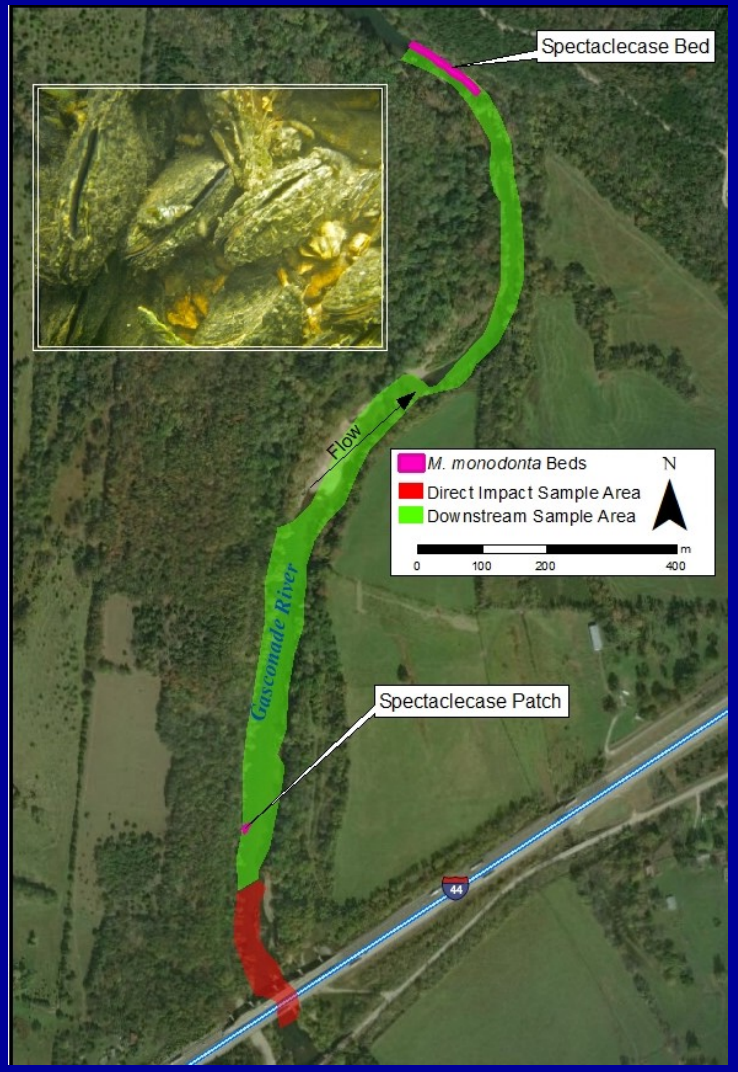
Project Examples

Gasconade River, I-44 Bridge (2011)

USFWS was concerned about known spectaclecase bed downstream and hellbenders

Initial mussel survey of direct and indirect impact area

Post-construction survey to evaluate hydraulic changes that can cause habitat alterations and monitor spectaclecase bed

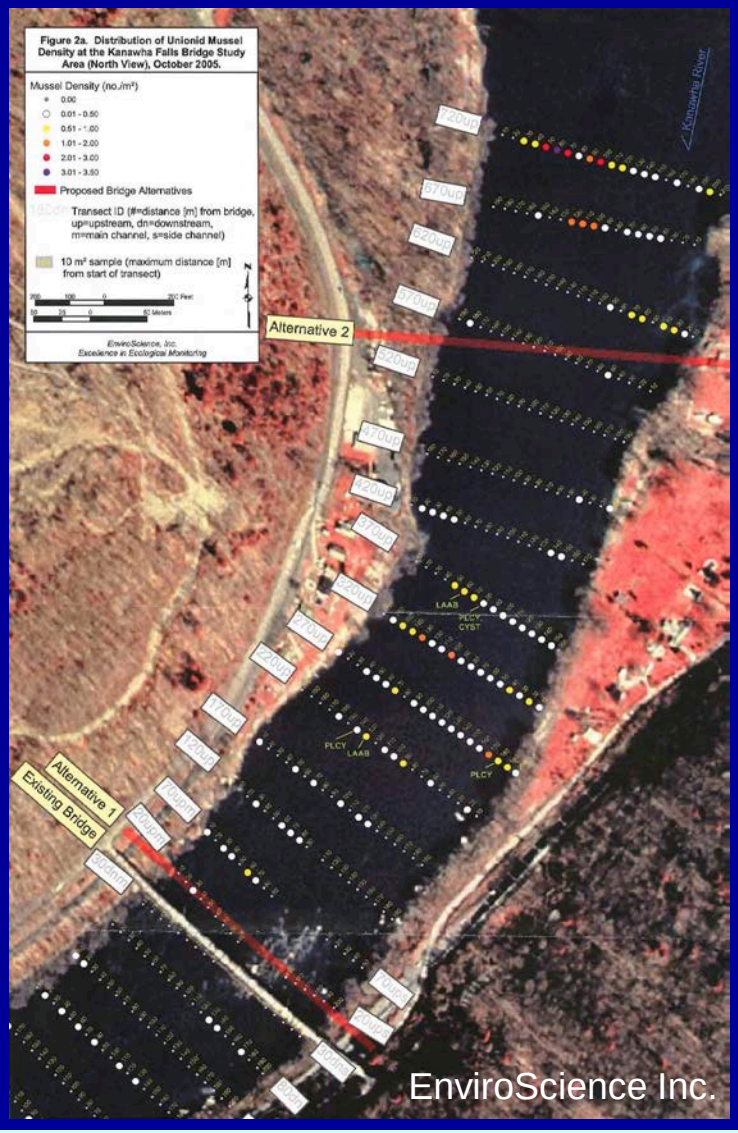


Avoiding Pitfalls

Consider mussels along with other environmental factors in selecting an alternative

Most state agencies & USFWS prefer you consider mussels in alternative selection

- Ex: WV mussel survey protocols require alternatives analysis



Avoiding Pitfalls

Consider mussel distribution in construction methods and pier locations

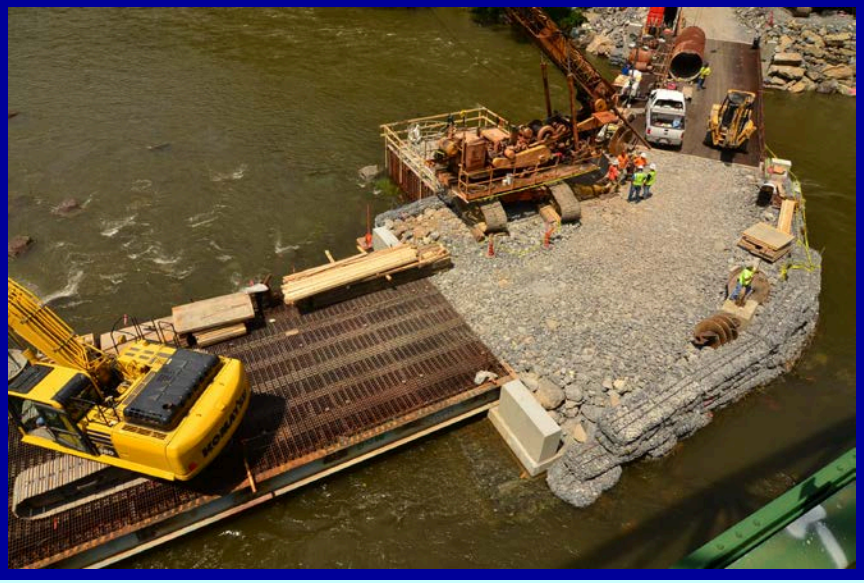
Avoiding impacts

- Span the river
- Place piers away from mussels (near thalweg)
- Avoid dredging and staging in areas with mussel concentrations

Avoiding Pitfalls

Minimizing impacts

- Elevated bridges or barges instead of causeways
- Gabion baskets/mattresses
- Stabilize substrate
- Recreate contours after construction
- Relocate mussels as a last resort



Avoiding Pitfalls

Mitigating impacts

- No mitigation banks at this time
- Habitat creation is experimental
- Other studies to enhance knowledge of mussels (e.g. I-74 poolwide survey)

Why not just relocate mussels?

Costly, labor-intensive

Habitat loss is a major factor in declining mussel abundance

Need to preserve and enhance existing habitat

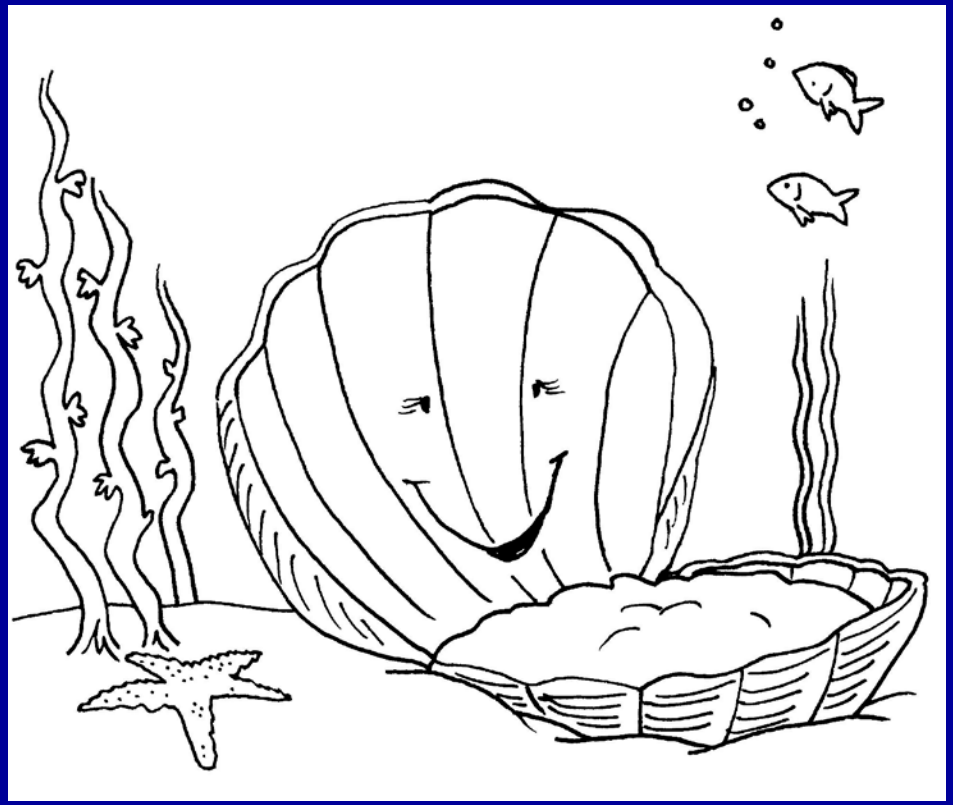
Summary

Freshwater mussels are present in most streams

Considering mussels, particularly T&E species, in construction planning to streamline regulatory process

- Alternative selection
- Avoid/minimize impacts in design and construction

Need to have happy clams in our rivers!



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