A solution for invasive carp in Minnesota

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ENVIRONMENT
AND NATURAL RESOURCES
TRUST FUND

Outline

- Today's Question
- Lessons learned about Aquatic Invasive Species (AIS) in MN
- Bigheaded carp
- A feasible option to stop the Bigheaded Carp invasion
- Summary
- Questions and answers

Silver Carp: the "invasive carp" of greatest interest

Today's Question:

Does Minnesota want to do anything to stop invasive carp, or not?

(Failure to act is a choice)

A decade ago, 5 AIS threatened the ecological integrity of our inland waters

- Common carp

- Curly leaf pondweed

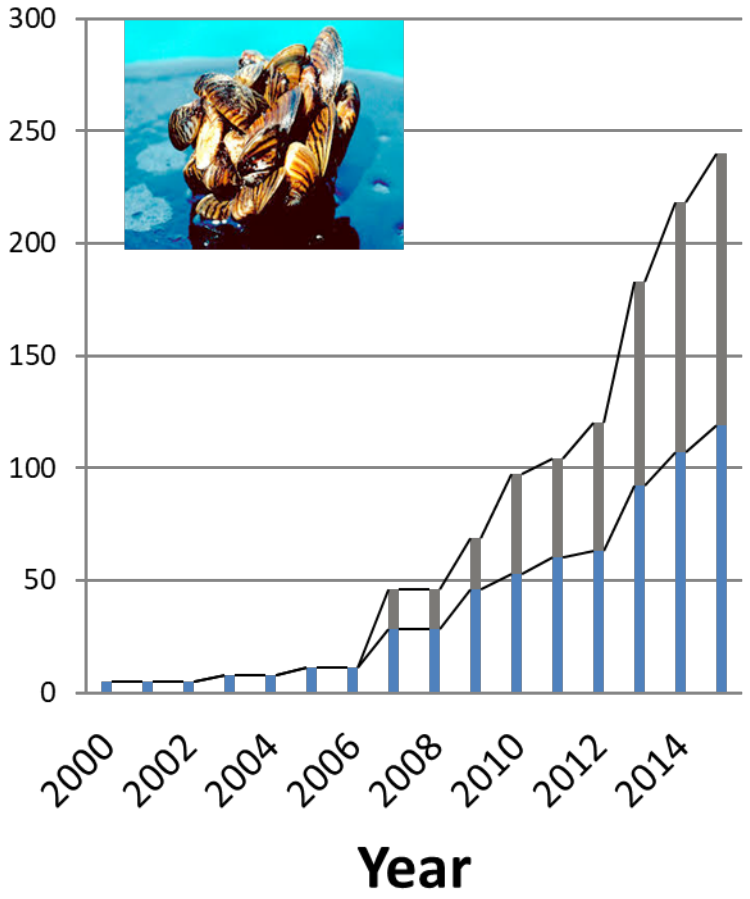
- Eurasian Milfoil

- Zebra mussel

- Bigheaded carp

Frankly, we have not done very well.

2022: Nearly 900 lakes (8%) are now infested and that number continues to grow for all species except one



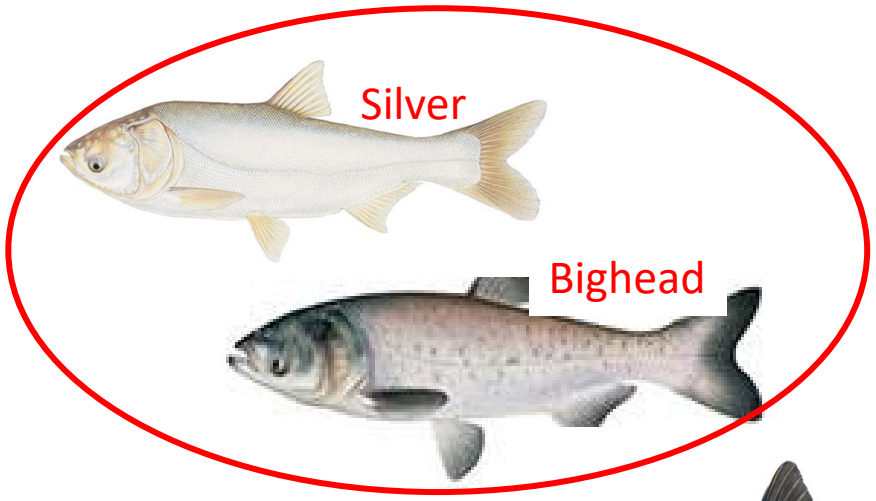
BUT: We still have one great opportunity to redeem ourselves with bigheaded carp!

5 AIS Lessons:

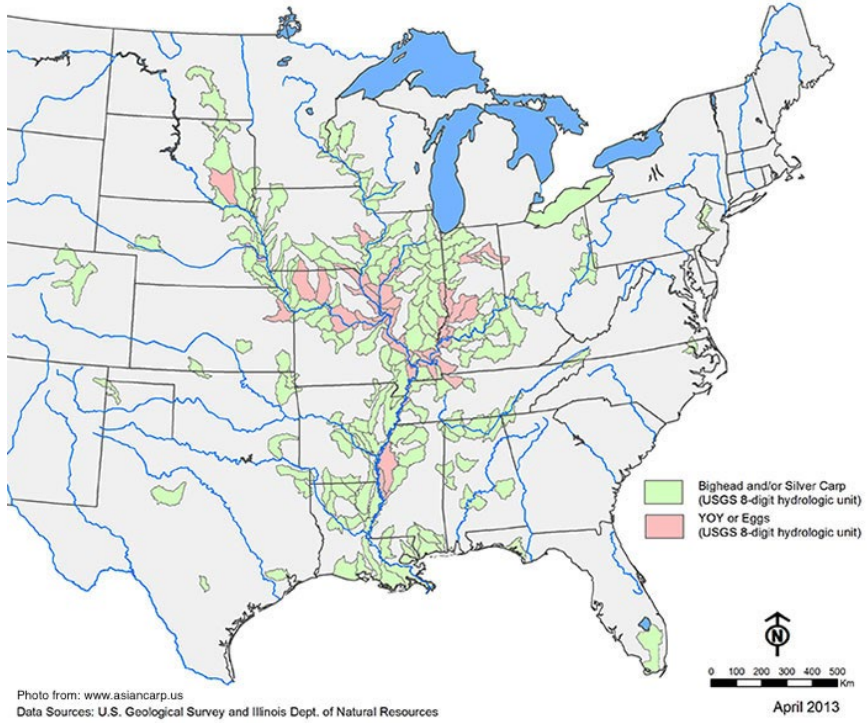
1. Preventing adult establishment (reproduction) is the only reasonable approach
2. Success does not require 100% efficiency, just a high number!
3. Multiple control measures are needed
4. Critical to act as very quickly, then adapt…
5. Failure to act is an action.

Bigheaded (Invasive) Carp

- 4 species of carp from Asia: Bighead, Silver (or Bighead**ed**), Black, and Grass
- 1960s: Introduced in Arkansas
- Spreading north and establishing (breeding and producing young)



2 species of Bigheaded carp



40 years of study: Bigheaded carps severely damage fisheries and waters

1. Driven a 50% reduction in native gamefishes in rivers (Chick et al. 2020 *J Biol Inv*).

2. Driven 10-25% reduction in the size of native planktivorous fish (ex. bigmouth buffalo; Irons et al. 2007. *J. Fish Biol*).

3. Driven a 90% reduction in macroplankton species richness (biodiversity) and abundance (Sass et al. 2014; *J Great Lakes Res*; DeBoerer, 2018. *Freshw Biol*).

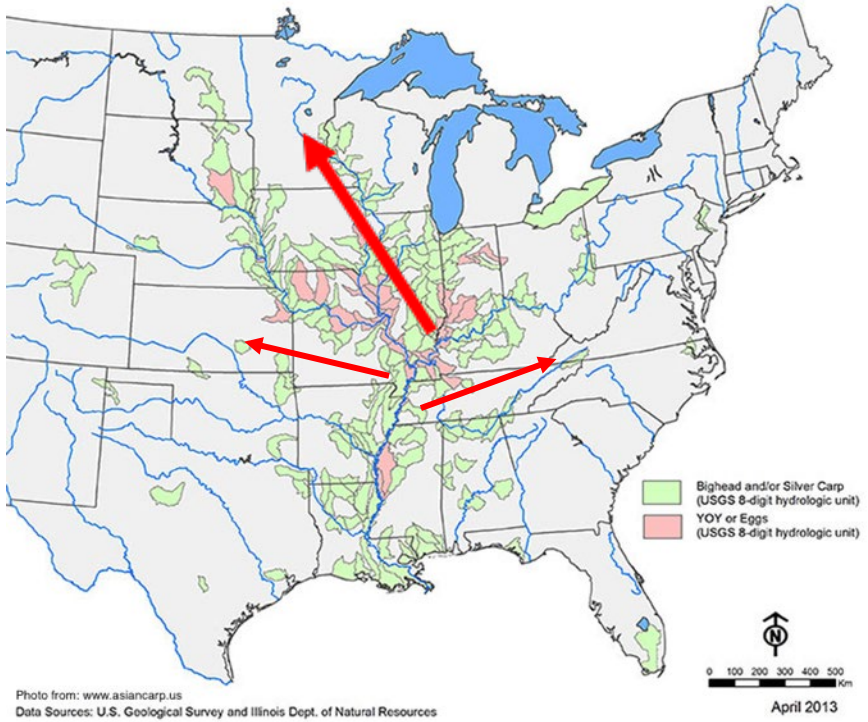
4. Reduced the size (57-87%) of larval fish and zooplankton (Fletcher et al. 2019).

5. Reduced the size of freshwater mussels (Tristano et al. 2019. *Aqu Conserv*)

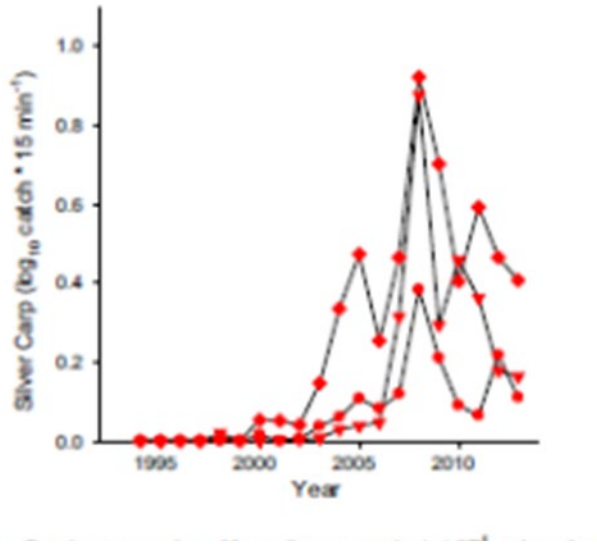
6. Caused eutrophication of the benthic environment (feces and bacteria) (Kolb et al. 2019)

Silver carp also jump 9 feet in the air, posing danger to boaters!

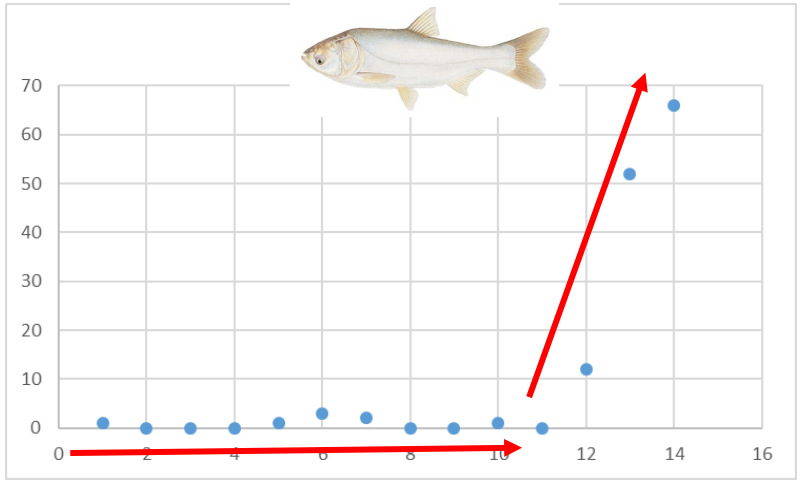
Carp presently invading Minnesota waters and now routinely being seen and caught



Silver carp now problematic in 12 states - a quarter of the USA!



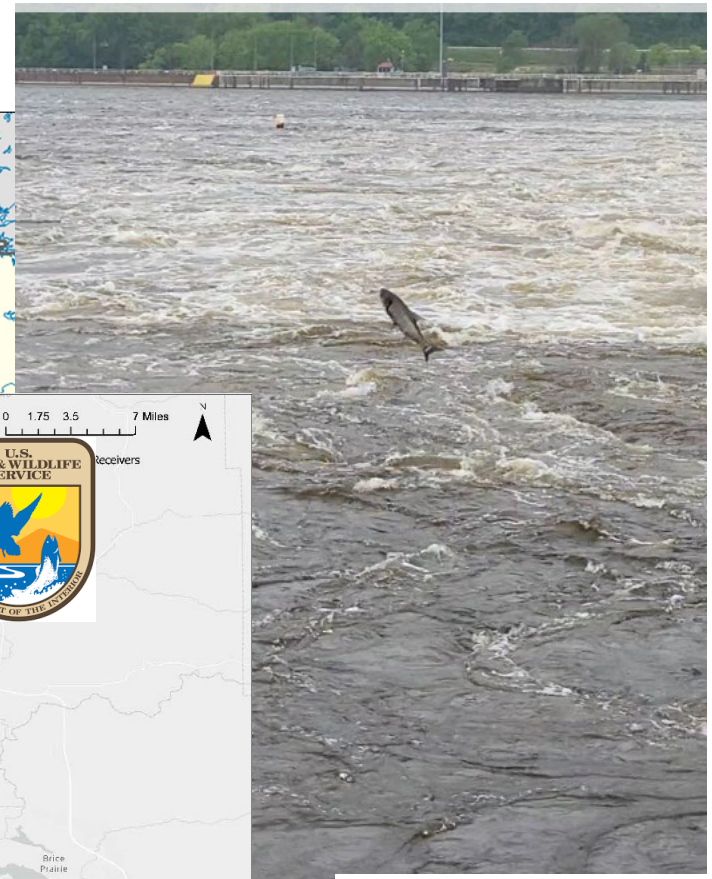
Rapid increase has been seen in Illinois after years of no change: sudden, explosive growth (Sass)



Adult Silver carp captures are now increasing dramatically in MN - nearly doubling each year, after years of no change

ONLY QUESTION: WHEN WILL THEY REPRODUCE IN POOL 8?

In particular, Silver Carp are now routinely seen in Pool5A (Winona), immediately below Lock & Dam #5



- Public sightings
- Confirmed by USFWS and U of MN:
  1 of 2 tagged silver carp in Pool 8 tracked here
- Confirmed by Brian Brecks and Bob Jumber, WI DNR:
  (June 6 and 8: " *jumping at a rate of once a min below the spillway*"

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This is extremely serious!

1) Lock and Dam 5 (LD5) is **the last place to stop these carp** south of the Twin Cities
2) **As few as 20 female carp** can be expected with 75% certainty to reproduce and create a viable population within as little as 10 years! (Cuddington et al. 2014)
3) **Once carp reproduce, prevention is not even possible,** only management.

Today, I describe a plan that could save the state from carp

- **Developed by UMN experts with $5 million LCCMR funding, project complete**
- **Predicted to stop 97-99% of all invasive carp**
- **Would save the entire state from Lock and Dam 5 (Lake Pepin and north)**
- **Would also help native fishes**
- **Reasonable** (multiple component with options, adaptive)
- **Developed by the UMN with LCCMR funding** ($5 million, 10 years)
- **Validated** by the scientific community (8 peer-reviewed publications)
- **Doable** (validated by Barr Engineering Co. Feasibility and cost analysis)
- **Reasonable Cost:** about $11 million—if not implemented, state will pay $2 million/year for carp control
- Must be **implemented now** (2023) to have a good chance of working

First, what are Locks and Dams and why stop carp there?

- 29 Locks and Dams (LDs) span the Mississippi River and regulate water depth

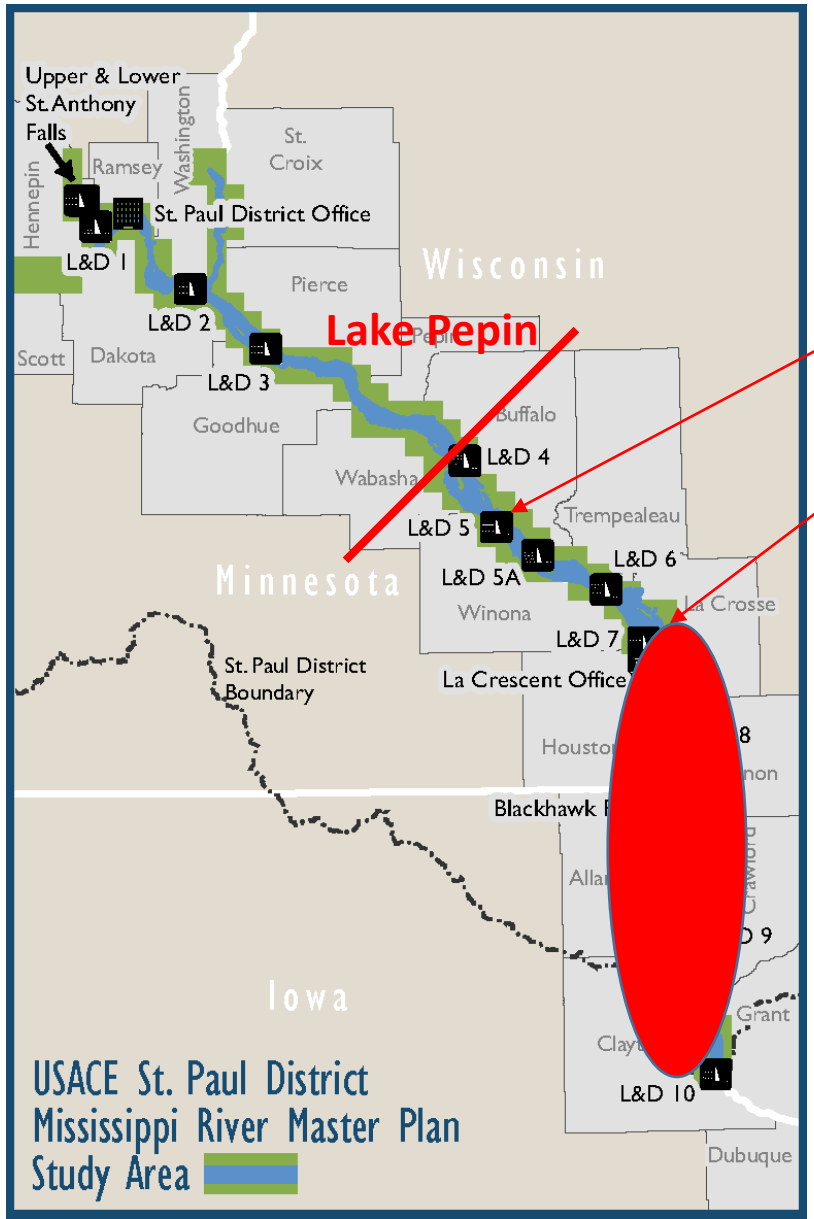
- **All fish swimming upstream must pass through them. Some LDs already stop 50-85% of fish.**

- **All LDs have several components that affect passage and provide excellent options for control:**
  1. A **navigation lock** (10% of structure, allows fish to pass when opened)
  2. A **dam with spillway gates** that open/close to maintain depth in lock (usually 90% of structure; the less they open, the less often fish can pass)
  3. Sometimes a fixed-crest overflow spillway with overflows and culverts.

Only 3 ways to pass

Six Locks and dams (LDs) between the “invasion front” at Pool 5A and Lake Pepin

LD4, LD5, LD5A, LD6, LD7, LD8



Silver carp now seen 2022

51 adult invasive carp caught in 2019

Adult invasive carp relatively abundant

4 criteria show that LD5 is the only place to stop carp, and it is excellent!

LD	lock can house deterrent	upstream pool (miles)	lacks fixed crest spillway	% of time gates passable
4	X	43.9	X	7.8%
5	X	14.9	X	2.5%
5A	X	9.6		18.5%
6	X	14.4		12.7%
7	X	11.6		8.0%
8	X	23.3		8.8%

What must happen at Lock and Dam 5 (Adaptive, integrated)

1. A carp deterrent must be added to LD5's lock
2. Carp must be removed above and below LD5
3. 4 small culverts along an 18000 ft embankment must be modified and managed
4. Adaptive management instituted

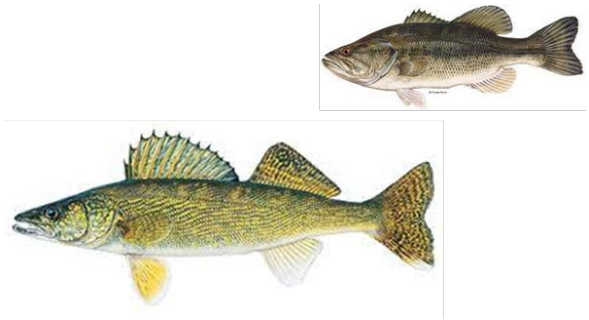
<u>Other great options:</u>

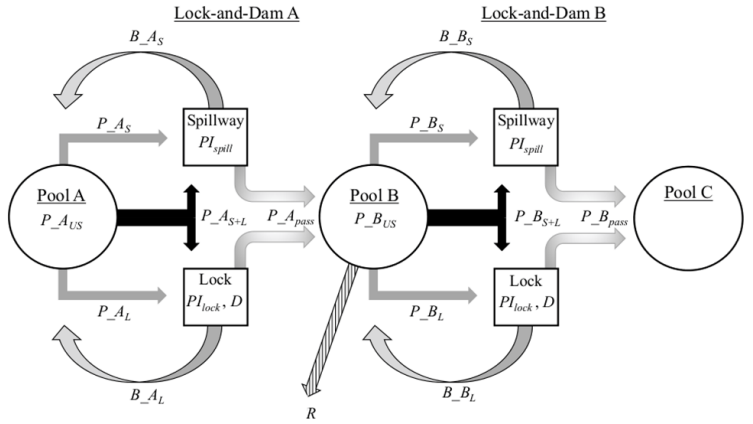
1. A fishway for native fish should be installed

2. Spillway gates could be adjusted

Numeric simulation shows that if these 4 strategies were pursued, LD5 will stop 99+% of all carp. *(This number is so high that any carp that might still pass will die of old age before reproducing).*

Dr. Zielinski, GLFC





Zielinski & Sorensen 2021

Ex. 3 of 108 options considered:

1. 66% efficient Deterrent at LD5, no gate modification, no removal: **~98.8 ±0.05 % blocked**
2. 66% efficient Deterrent at LD5, gates modified, 0% removal: **~98.9 ± 0.03% blocked**
3. 66% efficient BAFF at LD5, gates modified, 10% removal: **~99.6 ± 0.03% blocked**

(50% exceedance)

UMN asked Barr Engineering Company: Could this plan (including a carp deterrent) be deployed at LD5's lock, and in time to stop the carp?

"An Engineering Assessment of the Feasibility and Estimated Cost of Installing a State-of-the-art BAFF Carp Deterrent at Mississippi Lock and Dam 5"

7 Tasks addressed in the contract and resulting report:

1. Confirm location is best
2. Can an effective deterrent system be identified and installed at LD5?
3. What is the best type of deterrent?
4. Could the state get permits for this deterrent?
5. Are doubts (culverts, sound)expressed by earlier study (Putland &Mensinger) valid
6. How much would it cost?
7. Can it be installed in time?

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Barr Engineering Co. study confirmed that UMN plan is reasonable and feasible – but time is of the essence!.

1. No overtopping fixed crest spillways/submersible dams at LD5. (Only **4 small upstream culverts and they will stop all carp if managed correctly)**
2. Spillway gates only open 2% of the time
3. A Bioacoustic Fish fence (BAFF) deterrent is best
4. The lock can accommodate a BAFF deterrent
5. Sound levels where BAFF would be situated do not pose a problem
6. Carp can be effectivelyremoved from Pool 5 (with L&D 4 as a redundant upstream deterrent
7. A fish ladder for native fish can be added to LD5

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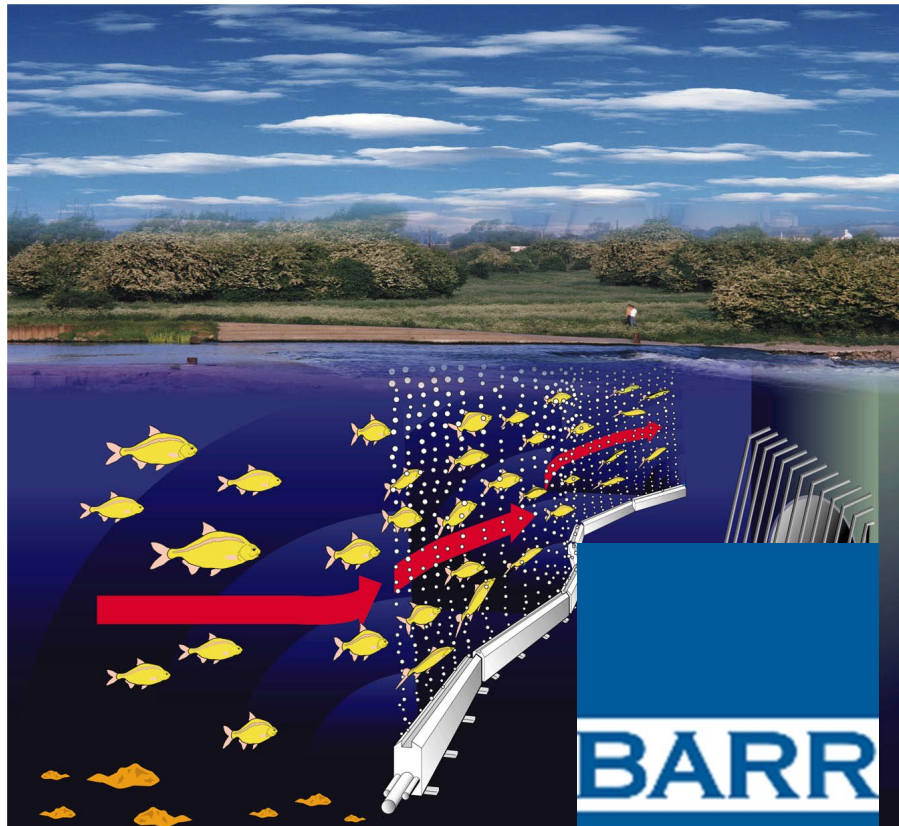
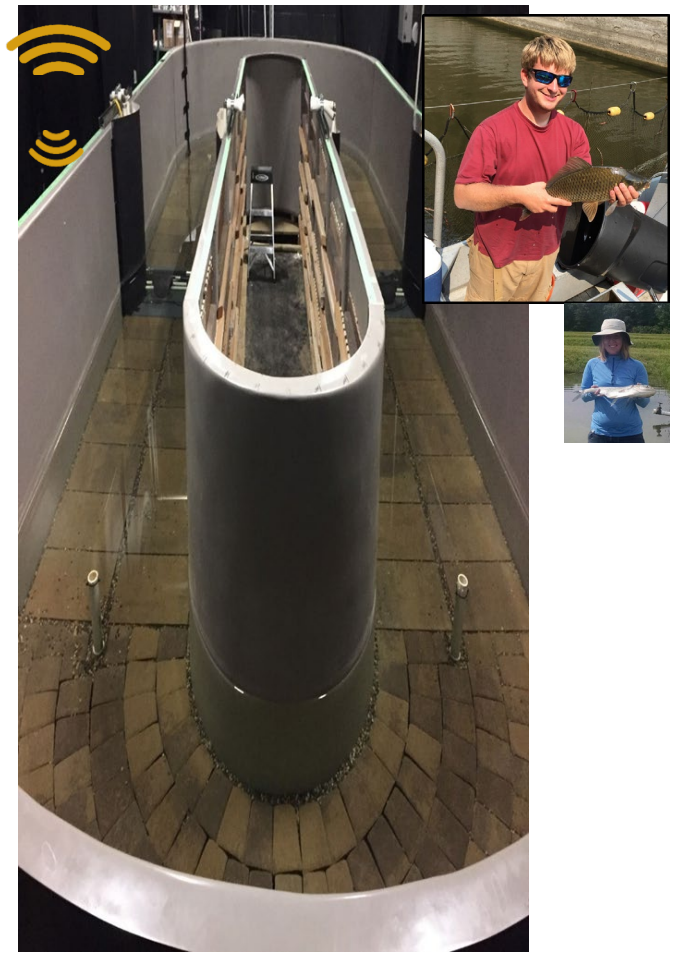
A Bioacoustic Fish Fence (BAFF)

- Combines acoustic signal with a bubble curtain to create a wall of sound (“multimodal”)
- Effective (lab and field, ambient sound levels are not a problem)
- Feasible, Affordable
- Safe

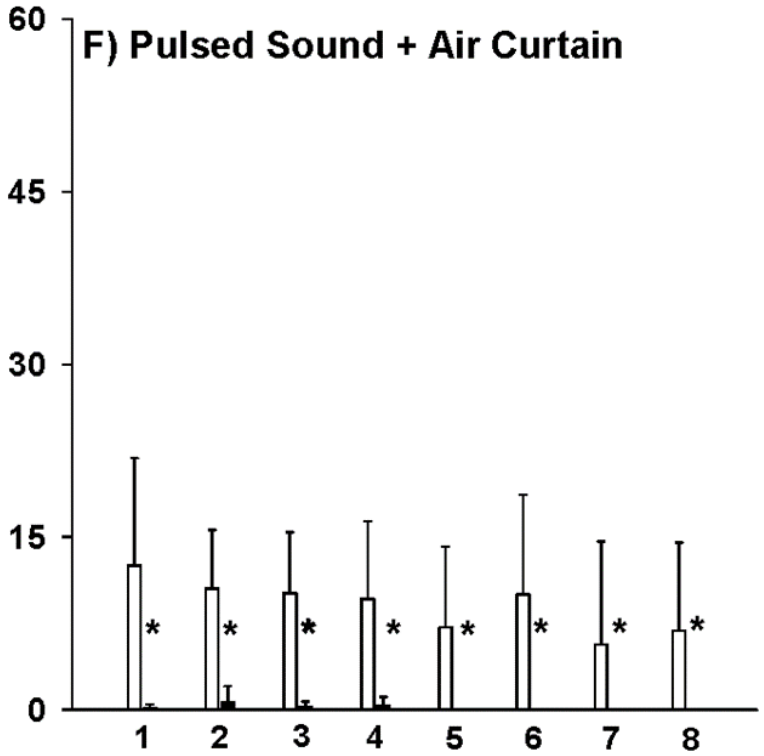


BAFF blocks 97% of invasive carp in published lab test



Air coupled with sound (Bioacoustic Fish Fence or BAFF)

97% BLOCK



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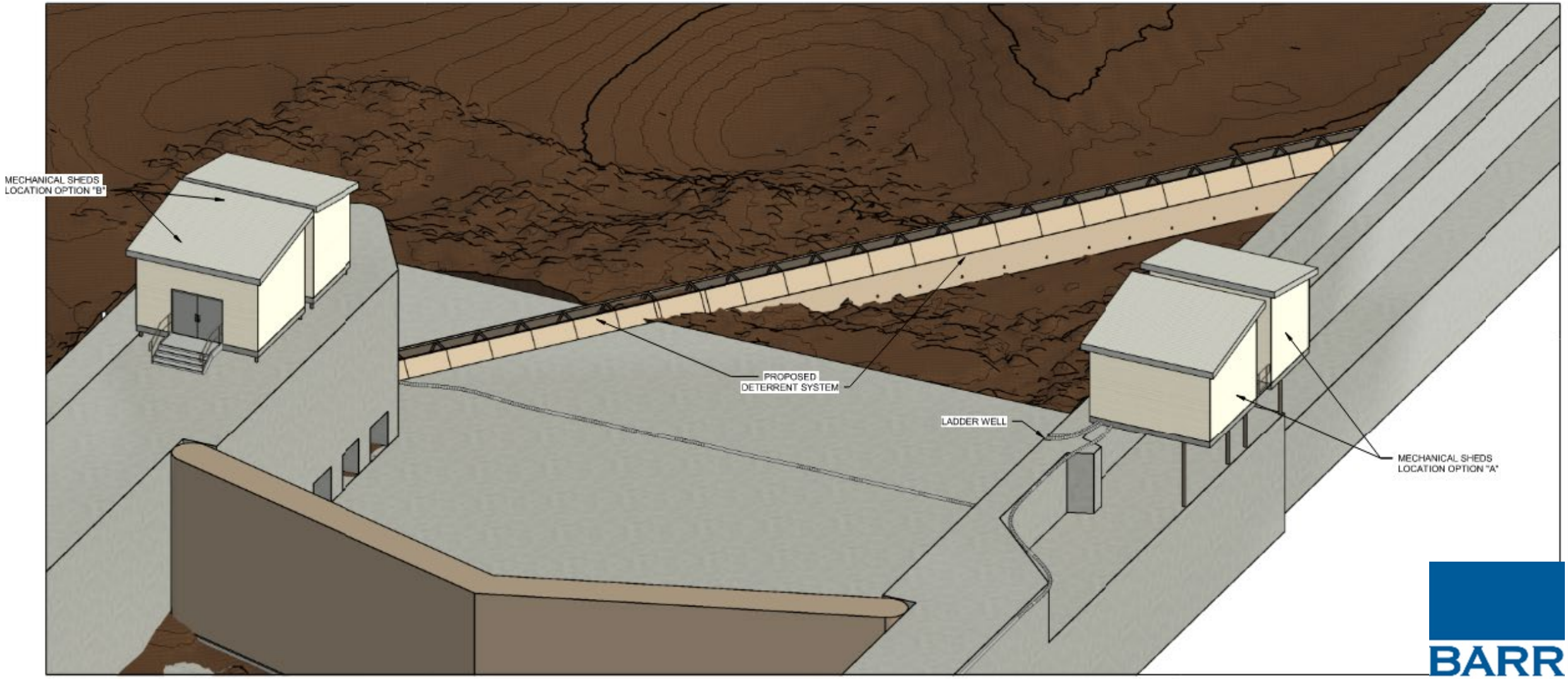
Published: Dennis et al. 2019 . Journal of Biol. Invasions

BAFF presently being tested by USFWS at Barkley Lock, KY (an operating lock with high boat traffic) with very favorable results!

~71% effective to date (easily enough)

Barr confirms a BAFF deterrent can be added at LD5: with 10% design deterrent system layout



Barr found that permits for a BAFF can be obtained relatively quickly

Agency	Authorization	Estimated Agency Review Timeframe
USACE	Clean Water Act (CWA) Section 404 and Rivers and Harbors Act Section 10 authorization	3 months to 1 year
USACE	Section 408 of the Rivers and Harbors Act of 1899 authorization	4 months to 1 year
USFWS	USACE consultation under Section 7 of the Endangered Species Act	Concurrent with USACE review
SHPO	USACE consultation under Section 106 of the National Historic Preservation Act	Concurrent with USACE review
MPCA	CWA 401 Water Quality Certification (WQC)	Not applicable for Nationwide or Regional General Permits 1 year for an individual WQC for a Standard Permit
MPCA	Dredge Materials Management SDS Permit	6 months to 1 year
DNR	Public Waters Work Permit	3 to 6 months
DNR	NHIS Review and Takings Permit for Threatened/Endangered Species	2 months

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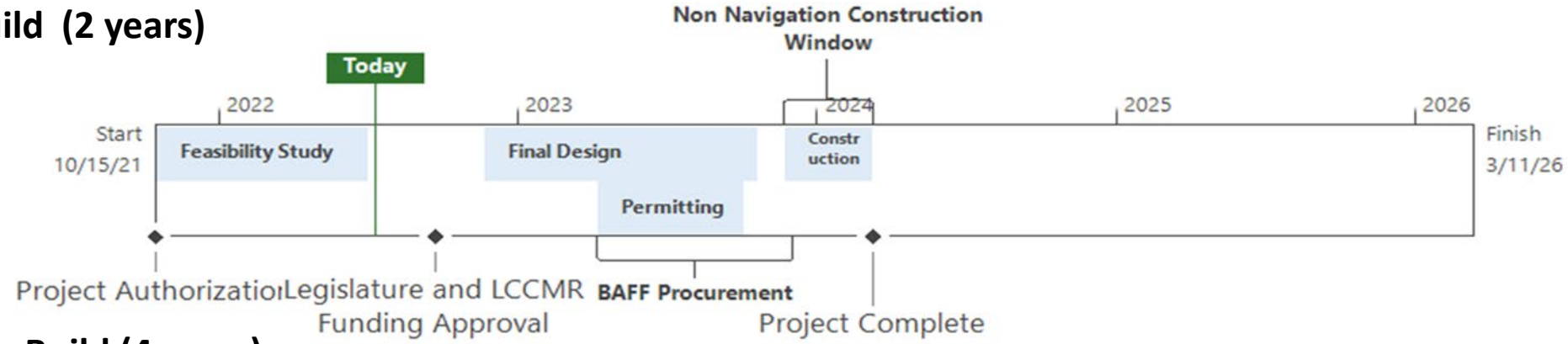
BUT time is of the essence:
Barr's study shows it will take 2-5 years to install a BAFF

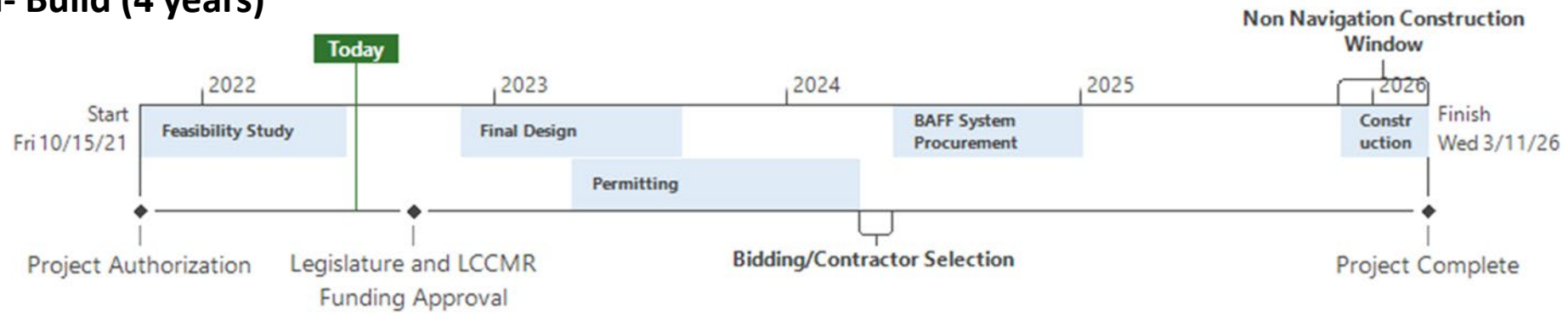
5 years is just enough time based on carp passage rates and experience at LD19

MN DNR must make a decision in 2022 to be sure of success

Design- Build (2 years)



Bid-Design- Build (4 years)



Barr's study shows BAFF cost will be between $8-16 million

	Item	Estimate of Probable Construction Cost	Notes
1	Engineering	$468,000	8% of items 2-8 (excluding BAFF furnished cost); includes engineering, survey, geotech investigation, and construction observation
2	Mobilization and Demobilization	$800,000	Includes mobilization of contractor, dive crew, barges and crane
3	BAFF Components & Initial Installation	$7,242,000	BAFF enclosure and foundation, wiring to BAFF system, compressed air lines
4	Compressor Shed	$290,000	Pre-engineered building, compressor, HVAC, finishes
5	Electrical Shed	$141,000	Pre-engineered building, electrical panels, HVAC, finishes
6	Utilities and Power	$235,000	Transformer, generator, propane, electrical service
7	Contractor Overhead	$871,000	10% of items 2-6
8	Contingency	$1,741,000	20% of items 2-6
	Total:	$11,788,000	
	Lower Range (-30%)	**$8,252,000**	
	Upper Range (+40%)	**$16,503,000**	

Notes:
1) **Cost estimate based on AACE (17R-97, Class 4, -30%/+40%)**
2) **Costs are based on conceptual 10% level of design**
3) **Budgetary quotes were supplied for the FGS BAFF system, compressor and shed enclosure**
4) **All numbers rounded to nearest thousand**

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Summary

- Invasive carp are now in MN and could reproduce anytime – **now or never**.
- Using a **combination of 4** available techniques at LD5 we could **stop over 99% of Bigheaded Carp** passage right now in MN/WI, sparing Lake Pepin, and the St Croix and Upper Mississippi Rivers
- **No single technique, many options—but a BAFF lock deterrent is key.**
- Carp control can be achieved with **little effect on native game fishes** in the river, in fact it **may even allow improvement if fishway installed**
- **A decision needed in asap to start in 2023**

- <u>Recommended Next Steps</u>:
  - Funding for 60% design (300K)
  - Expedited decision by the DNR to get the BAFF into 2023 biannual budget, build

Thank You!

QUESTIONS?