USE OF AN INTEGRATED ASIAN CARP MANAGEMENT FRAMEWORK: APPLICATION IN THE MISSISSIPPI RIVER BASIN

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Two spp. of interest BHCP SVCP

Large-bodied planktivores

Introduced to control water quality in aquaculture ponds

Escaped and can now be found in several states throughout the country
ASIAN CARP PERSIST IN MANY LOCATIONS

Rapid growth rates

Extensive migratory ability

Tolerate wide range of conditions

Lack of natural predators

Extremely efficient feeders

High fecundity

Short generation time

Great invader...Not good but true
WHAT ARE THE POTENTIAL IMPACTS ON AQUATIC SYSTEMS?

Alter habitats and compete with native species which disrupts ecosystem structure and function...altering riverine foodwebs

However, because Asian carp are a fairly recent invader...much information unknown
INTEGRATED ASIAN CARP MANAGEMENT FRAMEWORK

1. Determine if Asian carp are injurious to the ecosystem
2. Evaluate the spatial extent of the problem
3. Identify measures for control
4. Synthesize information from above to prevent establishment in novel environments and determine future efforts
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PROJECTS

Compare native planktivore relative abundance before and after AC invasion (Main River)

Evaluate fish community changes in Mississippi River floodplain lakes (Floodplain)

Determine if competition exists between GZSD/BMBF and AC in controlled setting (Lab)
Big Picture here is that Carp populations have been increasing rapidly since 2003...

Followed by simultaneous declines in native fish abundance in the mainstem river. But what about floodplain fish communities?
Floodplain connectivity benefits native juvenile fishes. Strong year classes related to floodplain connectivity (prior to 2003), but the benefits reduced after 2003...why?

Short answer is AC...highly diverse FP fish community in 1993 but by 2015 AC make up ~95% of the catch on the floodplain.

Are AC outcompeting our native fishes for prey resources?
Well, to answer that question we did some controlled laboratory experiments.

We determined that in the presence of AC, both bigmouth buffalo and gizzard shad had reduced growth or survival.
Asian carp are likely influencing native fishes

Specifically, we have demonstrated fishes within the Mississippi River and its floodplain may be at great risk

But where should we focus control efforts? Only in the Mississippi River????...We are dealing with a massive interconnected highway of multiple rivers- Do Asian carp move among these rivers?

WHAT DOES ALL OF THIS MEAN?
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Different Geographic Locations

Quantify Movement & Habitat Use
Asian carp are wide ranging in the Mississippi River Basin and can move freely throughout this interconnected highway of rivers with a mosaic of habitats. Fundamental to define spatial bounds on populations and identifying fine scale habitats used to develop management or harvest strategies.
To evaluate origin (location of reproduction), movement, and habitat use otolith microchemistry and ultrasonic telemetry AC were collected near the invasion center.
Not surprising 64% originated or spent majority of life in Mississippi River

More alarming may be the 36% of fish captured in the Mississippi River spent time or originated in another river!!!
No seasonal pattern

High incidence of movement among rivers and passage through barrier- but hydropower dams and lock chambers pinchpoint

Biggest movers- Downstream to Mississippi and upstream to the upper reaches of the IL River some well over 700 miles
No apparent trends in habitat use...habitat generalists

Backwater low velocity habitats may provide areas of concentration for subadults
Both methods suggest extensive movement - AC move freely among rivers, across many political boundaries - encompassing multiple state management agencies. Big rivers provide migratory swimway for highly mobile fish.

Telemetry suggests habitat generalists - but during early life may use backwater habitats (shallow and slow).

In order to effectively manage these highly mobile fish populations, inter-jurisdictional collaboration will be necessary...but what about control?
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USE OF HARVEST SIMULATION MODELS FOR ASIAN CARP POPULATIONS IN SEVERAL U.S. RIVERS
~45% exploitation at ≥300 mm (prior to maturation) to overfish the population

Focus on areas of high subadult abundance (backwater) for harvest

So now that we have garnered all this info-
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Beginning to model the potential influence of invasion in novel reaches of the Mississippi River and guidance for control

Developing technology to prevent passage through lock chambers
1. Habitat suitability models (all life stages)

2. Lower trophic levels effects (zp, pp, det)

3. Fully develop markets

4. Learn from other successful control programs (i.e., sea lampreys)

5. We all must work together!!
Mississippi River Fishery Commission
Ultimately, this multi-tiered approach to investigate the Asian carp invasion has provided insight to numerous state and federal agencies to maintain the structure and function of river ecosystems and ensure sustainability of our native biota.
KANSAS CITY • The discovery of two juvenile black carp in a ditch connected to the Mississippi River in Missouri is the first, troubling sign that the invasive species is reproducing in the wild and becoming more of a threat to already endangered mollusks and some native fish, scientists say.

While adult black carp have been found sporadically in the Mississippi, the November discovery near Cape Girardeau of juvenile fish among the hundreds of fish caught showed the black carp population in the river is higher than scientists expected, Missouri Department of Conservation resource scientist Quinton Phelps said, and that there’s a “high probability” that more black carp were caught.
I would like to acknowledge all of the graduate/undergraduate students and staff that made this research possible.

Furthermore...I would also like to thank the multiple funding agencies for each of these projects...including the Missouri Department of Conservation, United States Geological Survey, United States Fish and Wildlife Service, and the United States Army Corps of Engineers.
Ultimately, this multi-tiered approach to investigate the Asian carp invasion has provided insight to numerous state and federal agencies to maintain the structure and function of river ecosystems and ensure sustainability of our native biota.

**OVERALL CONCLUSIONS**

- Determine if Asian carp are injurious to the ecosystem
- Evaluate the spatial extent of the problem
- Identify measures for control
- Synthesize information from above to prevent establishment in novel environments.