Hitchhikers on the hitchhikers: Novel viruses to control invasive fish populations

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Common Carp: 
Cyprinus Carpio
<table>
<thead>
<tr>
<th>Carp Populations</th>
<th>Controls</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Clear State" /></td>
<td><img src="image2.png" alt="Seining" /></td>
<td>Lake Size/type, Labor intensive</td>
</tr>
<tr>
<td><img src="image3.png" alt="Turbid State" /></td>
<td><img src="image4.png" alt="E-fishing" /></td>
<td>Lake Size/type, Labor intensive</td>
</tr>
<tr>
<td><img src="image3.png" alt="Turbid State" /></td>
<td><img src="image5.png" alt="Poisoning" /></td>
<td>Lake Size/type, non-target effects</td>
</tr>
<tr>
<td><img src="image3.png" alt="Turbid State" /></td>
<td><img src="image6.png" alt="Biocontrol" /></td>
<td>Lake Size/type, non-target effects</td>
</tr>
</tbody>
</table>
Koi Herpes Virus, KHV
(aka. Cyprinid Herpes virus 3, CyHV-3)
Why not KHV in the United States?

1) Possible non-target effects: There are many cyprinids native to the United States and Minnesota.

2) Government regulations on the use of exotic pathogens as biocontrol in the USA. i.e. Clinton Executive order 11987 on the introduction of exotic species & The Food and Agriculture Organization International Code for the Import and Release of Exotic Biocontrol Agents.
Research focus:
Exploring whether native pathogens can be used to control aquatic invasive species

A good candidate pathogen candidate would be:
Self-sustaining
Species-specific pathogen of carp
Easily spread through a population
Highly virulent
1. Sampling

A. From fish kills of native species and carp
1. Sampling

A. From fish kills of native species and carp

B. From healthy populations of carp
1. Sampling
   A. From fish kills of native species and carp
   B. From healthy populations of carp

2. Identification of candidate Pathogens

   - Pathogen 1-3: found in sick natives and carp
   - Pathogen 4-5: found in many healthy carp
   - Pathogen 6-8: found in sick carp only
1. Sampling
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2. Identification of candidate Pathogens
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3. Trials of candidate pathogens
   - Pathogen 6-7: replicates in native species
   - Pathogen 8: highly virulent in carp only
Zebra mussels

- Sample collection from different lakes in Minnesota
- Screening for viruses to generate baseline virome information
- In vitro propagation of potential viruses
- Challenge experiments
- Risk-assessment
LAST YEAR: Novel RNA viruses in apparently healthy carp

**Common carp**
- Astrovirus
- Picornavirus
- Calicivirus
- Hepevirus
- Nodavirus
- Reovirus

**Silver carp**
- Hepevirus

All samples negative for KHV, CEV and SVCV
Novel viruses in mortality events

Common carp
➢ Picornavirus
➢ Grass carp reovirus

Bighead carp
➢ Paramyxovirus
Fish Kills and Invasive Carp Sampling
Summer/Fall 2017 So Far:
14 total sites from:
- 12 mortality events (fish kills)
  - 4 from carp mortality events (Red)
- 2 survey samples (Green)

Pathogens detected from fish kills:
- A. sobria, P. shigellosis, & KHV

KHV was only detected in carp

First case of KHV outbreak in a wild population in MN!

Currently screening other carp mortality events for the virus.
Lake Elysian Carp Mortality Event Caused by KHV
Conclusions

1. The identification of KHV at Elysian demonstrates an early impact of this project in the improvement of fish kill investigations. We hope to continue to improve these investigations for quick and accurate diagnosis of Minnesota fish kills.

2. KHV is actively being considered as a biocontrol agent for carp in Australia, and its appearance in wild populations in Minnesota places it within the scope of this project. We are currently actively screening for KHV in other suspected cases.

3. The ultimate goal of this project is to evaluate previously identified viruses as biocontrol candidates, and novel pathogens of AIS in the effort to control them.
Implications for Management

1. Most importantly, the results will help to inform science-based risk assessments to pursue the use of viruses for invasive species control.

2. The results will benefit fish health management decisions that impact the short and long-term sustainability of native and invasive fish populations in Minnesota by identifying emerging threats.

3. Local, national, and international stakeholders will be encouraged to participate in the project to help guide implementation and maximize impact.
How you can help:

1. Report fish kills to the State Duty Officer 24/7 Dispatch by calling (800)-422-0798.

2. Then report to MAISRC researchers at z.umn.edu/fishkill.

Note the location of the event, details about the weather, the types of fish that were affected, as well as anything unusual about the scene such as an odd smell or a sheen or algae bloom on the water. Please do not clean up or try to collect dead fish as they may carry bacteria or toxins.

When you report a fish kill, you spark a fast and standardized response that helps the DNR inform the public about potential hazards. And when you report on our online database, you become part of a team that is working to reduce the effects of these events on Minnesota lakes and worldwide.
Acknowledgements

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