Using Commercial Fishing to Limit the Spread of Asian Carp

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Southern Illinois University

Photo by Blake Ruebush
Large numbers Asian carp provide significant grazing on aquatic resources with deleterious effects on native species.
Historical river monitoring has helped inform (Illinois Waterway)
Hydroacoustic estimates of Asian carp 2012 vs. 2013

Mean density (kg of fish / 1000 m$^3$) declined in all upper reaches
% decline between 2012 & 2013

<table>
<thead>
<tr>
<th>Location</th>
<th>SVCP</th>
<th>BHCP</th>
<th>AC</th>
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</thead>
<tbody>
<tr>
<td>Dresden</td>
<td>58.4</td>
<td>52.9</td>
<td>53.5</td>
</tr>
<tr>
<td>Marseilles</td>
<td>23.1</td>
<td>74.7</td>
<td>54.8</td>
</tr>
<tr>
<td>Starv. Rock</td>
<td>56.1</td>
<td>67.4</td>
<td>60.6</td>
</tr>
</tbody>
</table>

*Significant difference between 2012 and 2013*
Approach and Target Areas

**Illinois River**
- Independent Commercial Harvest as Control
  - China-US (TNC) partnership may help increase
  - Business development
- Market driven
- Assessing Population Demographics and Response
- Content/contaminant

**CAWS & Upper Des Plaines**
- Physical Barriers
- Monitoring
- Response actions

**Upper Illinois and Lower Des Plaines**
- Detectable Population Front Monitoring
- **Contracted removal**
  - Small fish monitoring
  - Telemetry
  - Demographics
  - Modeling
  - Integrated Pest Management
BARRIER DEFENSE
ASIAN CARP CONTRACTED HARVEST IN THE
UPPER ILLINOIS WATERWAY

Grant funded

COMMERCIAL FISHING
ASIAN CARP HARVEST IN THE LOWER ILLINOIS WATERWAY

Commercial ventures for profit – market driven
Barrier Defense

Approach and Target Areas

Upper Illinois and Lower Des Plaines

- Detectable Population Front Monitoring
- **Contracted removal**
- Small fish monitoring
- Telemetry
- Demographics
- Modeling
- Integrated Pest Management
Electrofishing (Day and night)
Small and Large Hoop nets
Gill and Trammel nets
Fyke nets (shoreline and tandem)
Mini fyke nets (shoreline and tandem)
Contracted removal where commercial efforts are not permitted.

Reduced propagule pressure
Barrier defense
Seine potentially had 1,000,000 lbs of AC
Commercial Fishing for Removal (barrier defense)

Percentage of Asian Carp to Other Species

- Asian carp 78%
- Buffalo and Common Carp 19%
- Game fish 2%
- Others 1%

Data from 2011 collections
Species-specific densities

**Silver Carp**
- *Starved Rock*

- Marseilles
- Dresden

**Bighead carp**
- *Starved Rock*

- Marseilles
- Dresden

### Graphs
- Y-axis: Number of individuals per 1000 m²
HMS Pits, Marseilles

~34 miles to electric dispersal barriers

![Graph showing mean number of AC per 1000 m³]

- Main Channel
- HMS Pits

![Map of HMS Pits, West Pit, and East Pit]
Hydroacoustics

1. Data collection

2. Post-processing

3. Data analysis and species composition

4. Asian carp population estimates
   - Abundance
   - Biomass
   - Size structure

Survey transects
Population characteristics

- AC density ~2–3 times higher in lower River
- Size decrease in Marseilles and Dresden → harvest effect?
- Largest individuals (i.e. high reproductive potential) furthest upstream

![Silver carp graph](image)

![Bighead carp graph](image)
Upper River fish community biomass

<table>
<thead>
<tr>
<th></th>
<th>Starved Rock</th>
<th>Marseilles</th>
<th>Dresden</th>
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<tbody>
<tr>
<td>2012</td>
<td>34</td>
<td>52</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>48</td>
<td>54</td>
</tr>
<tr>
<td>2013</td>
<td>35</td>
<td>55</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>45</td>
<td>44</td>
</tr>
<tr>
<td>2014</td>
<td>37</td>
<td>54</td>
<td>63</td>
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<tr>
<td></td>
<td>63</td>
<td>46</td>
<td>37</td>
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</table>

% biomass density
- Blue = Asian Carp
- Red = Natives
Telemetry and carp movement 2014

Fish tagged in 2014

<table>
<thead>
<tr>
<th></th>
<th>Bighead carp</th>
<th>Silver carp</th>
<th>Hybrid Asian carp</th>
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<tbody>
<tr>
<td>Marseilles</td>
<td>15</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Starved Rock</td>
<td>23</td>
<td>23</td>
<td>4</td>
</tr>
<tr>
<td>Peoria</td>
<td>15</td>
<td>23</td>
<td>12</td>
</tr>
<tr>
<td>La Grange</td>
<td>9</td>
<td>31</td>
<td>10</td>
</tr>
<tr>
<td>Alton</td>
<td>16</td>
<td>14</td>
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Redetection rates

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<tr>
<th>YEAR</th>
<th>USACE</th>
<th>SIU</th>
<th>RECAP</th>
<th>Rate</th>
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<tbody>
<tr>
<td>2008</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>17</td>
<td>380</td>
<td>196</td>
<td>49.4%</td>
</tr>
<tr>
<td>2012</td>
<td>46</td>
<td>371</td>
<td>136</td>
<td>32.6%</td>
</tr>
<tr>
<td>2013</td>
<td>25</td>
<td>291</td>
<td>231</td>
<td>73.1%</td>
</tr>
<tr>
<td>2014</td>
<td>3</td>
<td>250</td>
<td>21</td>
<td>8.3%</td>
</tr>
<tr>
<td>SUM/Average</td>
<td>104</td>
<td>1,292</td>
<td>584</td>
<td>40.8%</td>
</tr>
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</table>

**25 acoustic tagged fish redetected by fishermen, and 49 $5 jaw tagged fish captured**
Dresden pool – population front

- Spatial distribution in Dresden pool
  - Bars = mean density ± 95 CI
  - Total AC abundance (percentages)

- Rock Run surveyed in 2014
Characterizing Risk: IWW and CAWS

Distances from Lake Michigan

37 miles  Dispersal barriers
55 miles  Adult Population Front
62 miles  Presence of Adults/Potential Spawning
64 miles  Observed Spawning activity (no larvae/YOY)
91 miles  Established population: Closest observed juvenile Asian carp (Heritage Harbor Marina, Starved Rock Pool)

Overall leading edge of adult Asian carp invasion has not changed since 2006 (Dresden Island Pool; I-55)

Three captures of adult BLACK CARP
2010: RM 27.5 Triploid
2013: RM 24 Diploid
2014: RM 22.5 Diploid

2014: Most upstream observation of small AC at Henry, IL (RM 190)
April 2015: Juvenile Silver Carp captured at Spring Valley, IL (RM 211)
April and June 2015: Juvenile Silver Carp captured at Peru, IL (RM 223)... 33 Miles upstream of Henry, IL
July and August 2015: Juvenile Silver Carp captured near Ottawa, IL at Sheehan Island (RM 236) in Starved Rock Pool... 46 miles upstream of Henry, IL
September 2015: Juvenile Silver Carp captured 2 miles downstream of Marseilles Lock at Heritage Harbor Marina... 52 miles upstream of Henry, IL

54 miles downstream of Barrier
Upper River AC density
Illinois River

- Independent Commercial Harvest as Control
  - China-US (TNC) partnership may help increase
- Business development
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Approach and Target Areas

Commercial Fishing
Commercial harvest (pounds) from Illinois River

![Graph showing commercial harvest from 2003 to 2011 for different fish species: Carp, Buffalo, Grass Carp, Asian Carp, and Channel Catfish.](image-url)
Commercial harvest 2003-2011

Asian carp
3 million lbs of Asian carp were harvested from the lower three reaches of the Illinois River (Fishing experiment, Meal)
3 million lbs of Asian carp were harvested from the lower three reaches of the Illinois River (Fishing experiment, Meal)

Changes in the population size structure, relative abundance, and sex ratios were evident in 2012 relative to 2011 for silver carp in the three lower reaches of the Illinois River.
• Catch per unit effort (CPUE) was significantly reduced by at least 33%.

• Length-at-age was significantly smaller.

• 17% more males than females, possibly due to size selective harvest of larger females.

• No age-1 or YOY Asian carp were collected in the three lower reaches of the Illinois River in 2012, indicating that 2011 and 2012 were poor recruitment years.

• Illinois River does not exhibit large annual spawns but spawning sporadic, but highly successful (2014-2015 best on record)
Peoria L&D
- 14 fish passing

Dresden L&D
- 14 detections in the lock
- 2 successful passages downstream (late Jul & late Aug)

Marseilles L&D
- 9 detections in lock
- 2 fish passed upstream (11-19 May)
- 2 passed downstream (2 Apr & 15 May)

Starved Rock L&D
- 13 fish were detected in lock
- 5 successful downstream passages

La Grange L&D
- 18 fish passing

Peoria L&D
- 14 fish passing

Detects in locks higher in 2014 higher than in 2013, with downstream movement, but additional fish tagged in lower river last year, accounting for some of the change.
Illinois River Commercial harvest Incentives Market development

http://agricultureguide.org/fishmeal-plants/

http://www.bombayharbor.com/Product/10959/The_Fish_Meal.html
Population Model, v.1 (Tsehaye et al. 2013)

\[ N_{a+1,t+1} = N_{a,t} e^{-M} (1 - v_a U) \]
Spatially explicit population model
<table>
<thead>
<tr>
<th>Federal and Regional Partners</th>
<th>State, Local, and Research</th>
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</thead>
<tbody>
<tr>
<td>U. S. Fish and Wildlife Service</td>
<td>Illinois Department of Natural Resources</td>
</tr>
<tr>
<td>- Carterville, IL</td>
<td>Illinois Natural History Survey</td>
</tr>
<tr>
<td>- Lacrosse, WI</td>
<td>Illinois Environmental Protection Agency</td>
</tr>
<tr>
<td>- Columbia, MO</td>
<td>University of Illinois</td>
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<tr>
<td>U. S. Army Corps of Engineers</td>
<td>Southern Illinois University</td>
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<tr>
<td>- Chicago District</td>
<td>Western Illinois University</td>
</tr>
<tr>
<td>- Rock Island District</td>
<td>University of Notre Dame</td>
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<tr>
<td>U. S. Coast Guard</td>
<td>Metropolitan Water Reclamation District</td>
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<tr>
<td>Great Lakes Fishery Commission</td>
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<tr>
<td>All Great Lakes States</td>
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<td>Ontario and Canada</td>
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Local and Regional partnerships are valuable and necessary, specifically for economic development.

(local efforts supported by State and Federal programs)

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