Carbon Dioxide-Carp
A new tool in the invasive species toolbox

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Teresa Lewis, U.S. Fish and Wildlife Service, Midwest Fisheries Center
Background

- Need for barriers/deterrents
  - CO$_2$ could be a non-physical fish barrier
  - Non-selective deterrent

- Recent research
  - Lab studies
  - Pond studies
  - Field study

- Next steps (FY19 projects)
  - Registration of CO$_2$ with USEPA
  - Engineering feasibility study

Carbon dioxide treatments at a water control structure on the Illinois River (Lewistown, IL)
Carbon Dioxide-Carp

- U.S. EPA registered on April 2019
- Current label
- Restricted to USGS, USFWS, USACE, State Resource Managers, or those under their direct supervision

Approved uses:
1. Asian Carp deterrent
2. Under-ice lethal control

Precautionary Statements:
Hazards to Humans and Domestic Animals
WARNING: May be flammable. Do not breathe vapor.

Environmental Hazards
This chemical is toxic to aquatic organisms and invasive species. Non-target organisms may be killed at higher concentrations than listed. Direct exposure must be avoided. Do not use in areas not suitable for disposal.

Restrictions:
Use is restricted to USGS, USFWS, USACE, State Resource Managers, or those under their direct supervision.

Approved uses:
1. Asian Carp deterrent
2. Under-ice lethal control

Carbon Dioxide-Carp
Active Ingredient:
Carbon dioxide 100%
Total

KEEP OUT OF REACH OF CHILDREN

WARNING

IF INHALED:
- Move victim to fresh air.
- If the person is not breathing, call 911, then give artificial respiration, preferably mouth to mouth if possible.
- Call poison control center or doctor immediately for treatment advice.

If you have the product container or label with you, call the National Poison Squad Information Center (NPC) at 1-800-442-3677 seven days a week, 6:30 to 4:30 PM Pacific Time. (Web site: www.npcr.on.ca)

Net Weight: 50 LBS
EPA Reg. No. 6704-95
EPA Est. No. 6704-W-1

Manufactured for:
U.S. Fish and Wildlife Service
United States Department of Interior
16th and C Streets NW
Washington, DC 20240

Lethal Control

All vessels and some invasive species under the ice in the treatment area are exposed to the ice. An ice thickness of 8 inches for 15 minutes will kill most species. Use only on ice that is frozen and thick enough to provide a stable platform for treatment. Do not use on ice that is too shallow or thin to support the user.

Precautionary Statements:
Hazards to Humans and Domestic Animals
WARNING: May be flammable. Do not breathe vapor.

Experimental Hazards
This chemical is toxic to aquatic organisms and invasive species. Non-target organisms may be killed at higher concentrations than listed. Direct exposure must be avoided. Do not use in areas not suitable for disposal.

Restrictions:
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Approved uses:
1. Asian Carp deterrent
2. Under-ice lethal control

Engineering feasibility study

• Multi-agency research project
• Fox River Navigational System Authority
• August-September 2019

Testing objectives:
• Engineering and economic assessment
• Effects on water quality
• Air quality (human safety)
• Non-target effects
• Fish behavioral responses
Engineering feasibility study

• Preliminary results
  • Treatments to 100-150 mg/L CO2 took ~10 min
    • At warm water temperatures and high algal biomass
  • pH at target concentration for this water body is 6.2-6.4
  • Atmospheric levels much less than OSHA standard (8-h, 5,000 ppm)
  • Low CO$_2$ concentrations leaving the lock after filling and flushing
## Cost estimates

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<th>Target Concentration (mg/L)</th>
<th>Cost ($/lb CO₂)</th>
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<table>
<thead>
<tr>
<th>Estimated cost for one lock volume (low water)</th>
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<tbody>
<tr>
<td>Lock volume (cubic meters)</td>
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<tr>
<td>Target (mg/L)</td>
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<tr>
<td>CO₂ cost ($/lb)</td>
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<tr>
<td>Gas-transfer efficiency (%)</td>
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<tr>
<td>Estimated Cost</td>
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<tr>
<td>Total CO₂ (lb)</td>
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</table>
Potential Uses at Brandon Road

- CO$_2$ is not currently in TSP at BRLD
- Potential applications for CO$_2$
  - Intermittent use in lock or approach channel
  - Supplement existing deterrents (e.g., electricity, acoustics)
  - Backup plan during scheduled or unscheduled maintenance
- Next steps
  - Data analysis and summaries from Kaukauna lock project
  - State registrations
  - A&E for permanent installations
  - Web platform for Carbon Dioxide – Carp access and reporting (Jan 2020)
Acknowledgements and Contacts

• Contacts:
  • Kim Fredricks, kfredricks@usgs.gov, 608-781-6287
  • Teresa Lewis, teresa_lewis@fws.gov, 608-783-8420
  • Mark Gaikowski, mgaikowski@usgs.gov, 608-781-6221

• Collaborators
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