

M.L. 2021 Minnesota Aquatic Invasive Species Research Center Subproject Abstract

For the Period Ending June 30, 2024

SUBPROJECT TITLE: MAISRC Subproject 4.4: Acoustic conditioning in common carp to accelerate removal and reduce cost

SUBPROJECT MANAGER: Dr. Przemek Bajer

ORGANIZATION: University of Minnesota

COLLEGE/DEPARTMENT/DIVISION: College of Food, Agriculture, and Natural Resource Sciences; Department of Fisheries, Wildlife, and Conservation Biology

MAILING ADDRESS: 135 Skok Hall, 2008 Upper Buford Circle

CITY/STATE/ZIP: Saint Paul, MN 55108

PHONE: 612-625-6722

E-MAIL: bajer003@umn.edu

WEBSITE: <https://maisrc.umn.edu/carp-biocontrol>

FUNDING SOURCE: Environment and Natural Resources Trust Fund (ENRTF)

LEGAL CITATION: M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 06e

SUBPROJECT BUDGET AMOUNT: \$270,430

AMOUNT SPENT: \$185,952

AMOUNT REMAINING: \$21,478

Sound bite of Project Outcomes and Results

Pairing bait with an acoustic cue can synchronize common carp feeding aggregations in lakes, attracting more carp faster to the bait. Carp also appear to respond better to partial (bait not delivered every day) than continuous baiting strategies. Both strategies can be readily used to accelerate carp control while reducing cost.

Overall Subproject Outcome and Results

Common carp (*Cyprinus carpio*) is an invasive species in North America, causing significant harm to aquatic ecosystems through eutrophication, increased water turbidity, and the destruction of aquatic plants and fauna. A selective carp management strategy, bait-and-removal, uses carp-specific bait to gather and remove large carp aggregations with pop-up net systems. This method's effectiveness is limited by the variable size and duration of carp aggregations and the fact that only carp present at baited sites during removal can be captured. Acoustic conditioning, where carp are trained to associate a sound with bait delivery, could enhance this strategy by creating larger, more synchronized feeding aggregations.

To explore this, we conducted two studies on acoustic conditioning in common carp. In a laboratory setting where we trained carp to swim to a feeding ring at the sound of an acoustic cue, we found that carp remembered the conditioned behavior longer when exposed to partial reinforcement (bait delivered after some but not all acoustic cues) than continuous reinforcement (bait delivered after every acoustic cue). In a field study in Lake Minnetonka where automated feeders and underwater speakers were deployed, we found that although the acoustic cue alone did not attract carp to baited sites, sites that used both the acoustic cue and bait attracted 11% more carp than sites where bait was used alone. Also, the carp responded quicker to the bait (by 30%) when it was accompanied by the acoustic cue.

These findings suggest that acoustic conditioning can improve the efficiency of baited traps, potentially reducing removal costs. New research and challenges in common carp management were discussed at the inaugural Common Carp Workshop in March 2023, which brought together over 100 stakeholders. Key takeaways

included the ongoing need for funding, legislative support, and clearer permitting processes to enhance carp control efforts.

Subproject Results Use and Dissemination

Peer-Reviewed Publications

- Bullers, R., A. W. Bajcz, A. F. Mensinger, and P. B. Bajer. In progress. Assessing the presence of the partial reinforcement extinction effect in common carp using acoustic conditioning.
- Bullers, R., A. W. Bajcz, A. F. Mensinger, and P. B. Bajer. In progress. Synchronization of common carp (*Cyprinus carpio*) feeding aggregations through acoustic conditioning in a natural lake.

Select Presentations/Videos

- 2022 MAISRC Research & Management Showcase: Acoustic conditioning in common carp to accelerate removal and reduce cost
<https://z.umn.edu/2022ShowcaseCarpConditioning>
- 2023 MAISRC Research & Management Showcase: Acoustic conditioning in common carp to accelerate removal and reduce cost
<https://z.umn.edu/2023ShowcaseCarpConditioning>

Factsheets/Informational Documents

- Bullers, R.M. (2024). *Acoustic conditioning in common carp (Cyprinus carpio) to accelerate removal and reduce cost* [Masters Thesis, University of Minnesota]