



## Grass Carp Behavioral Ecology and Movement States to Inform Removal Strategies in the Sandusky River, Lake Erie

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*Caption: Three people stand at a table with a grass carp held in a fish cradle while one person performs surgery to insert an acoustic transmitter. Photo Credit: Scott Colborne*

**Goal:** Improve the efficiency of grass carp removal in the Sandusky River by using acoustic telemetry and behavioral state modeling to identify when and where fish are most vulnerable to capture, with a focus on diel movement patterns and backwater use.

**Objectives:** 1. Describe grass carp use of backwaters and movement patterns; 2. Classify behavioral states using acoustic telemetry data; 3. Identify key factors influencing state transitions; 4. Inform removal efforts by determining when and where fish are most vulnerable.

**Management Implications:** Results show that grass carp frequently occupy backwaters during the day and are most mobile at night, indicating that removal efforts could be improved by shifting effort timing, incorporating passive gear in backwaters, and targeting high-movement periods and locations to increase catch efficiency.

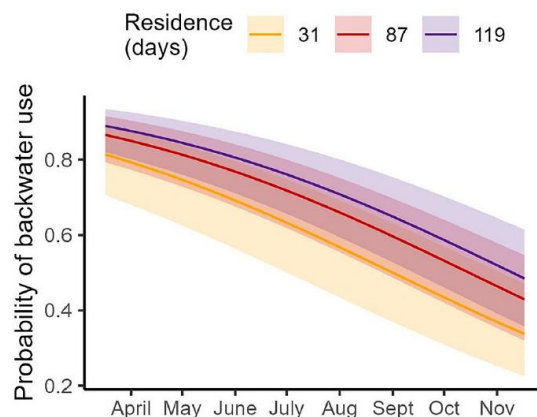
**Methods:**

- Acoustic telemetry was used to track fine-scale movements of tagged grass carp in the Sandusky River.
- Backwater habitat mapping classified fish locations as in, near, or outside backwaters.
- Hidden Markov Models identified behavioral states from step lengths and turning angles.
- Environmental and temporal covariates (e.g., time of day, temperature) were evaluated as drivers of movement behavior.

**Key Findings:**

- Grass carp consistently used backwaters during the day, making them less vulnerable to daytime removal efforts.
- Fish were most mobile at night, with higher movement rates and directed travel occurring outside backwaters.
- Time of day and backwater proximity were the strongest drivers of behavioral state changes.

**Deliverables:** Bonjour, S.M., R.D. Hunter, J.J. Roberts, T.O. Brenden, S.F. Colborne, M.D. Faust, C.M. Mayer, R. Mapes, R.T. Kraus, R.D. Calfee, and M.R. Acre. 2025. Grass carp (*Ctenopharyngodon idella*) movement states and backwater use can inform removal efforts. Journal of Great Lakes Research 51(5): 102654. [Download here.](#)



*Caption: Probability of grass carp using backwater habitat throughout the year based on total time in the Sandusky River.*

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