Leading Edge Suppression of Asian Carp in the Ohio River

2016 Technical Report

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Introduction:
Eradication of invasive species after establishment is difficult and often limited by available resources. Since their introduction in the Mississippi River basin, Asian carp (silver carp, bighead carp, and grass carp) have steadily increased their range. Asian carp rapidly and densely colonize river reaches affecting the native food web in large river ecosystems (Irons et al. 2007, Freedman et al. 2012). As a result, significant funding has been allocated in the basin to limit the impacts of Asian carp where they exist as well as halt their spread into uninhabited waters.

Diverse and consistent removal efforts where Asian carp densities are relatively high may disrupt upriver movement of Asian carp. However, there are few tools available to limit the negative impacts of Asian carp and their spread into new waters. Integrated pest management approaches include barrier technologies that prevent movement of the Asian carps into critical areas as well as the targeted removal of Asian carp below barriers to decrease propagule pressure (Tsehaye et al. 2013). Planning and implementation of barriers to Asian carp movement are widely believed to be an important aspect of the control of Asian carp in the Mississippi River basin. However, planning barrier projects requires an understanding of the distribution and abundance of invading populations, which requires years of data collection. Urgent efforts to gather this data in the Ohio River basin began in earnest in 2015 and will continue in the foreseeable future. In the meantime, the best tool for limiting impacts and dispersal of Asian carps is the physical removal of fish.

For this project, the term “leading edge” was intended to define the geographical range where carp populations are noticeably lower when compared to adjacent downstream locations. The bottom of this range is generally accepted to be McAlpine Lock and Dam (RM 606); above this point, there is a prominent decrease in carp abundances. Multi-agency sampling and removal projects have successfully targeted Asian carp along this reach, but the effort required is usually extensive. Removal of Asian carp along this stretch of river reduces the number of Asian carp moving upstream, lessens the likelihood of successful reproduction, and buys managers time to plan and implement potential barriers to Asian carp movement.

Objectives:
- Remove Asian carp from the leading edge of invasion along the Ohio River, above river-mile (RM) 606.
- Compare methodologies and gear types to increase efficiency of Asian carp removal.
- Provide data for monitoring and response efforts and utilize active telemetry to inform removal efforts.

Methods:
Leading Edge effort in 2016 was originally defined as work in Ohio River pools above RM 606. Due to a geographical overlap with the Control and Removal project and a higher focus on decreasing propagule pressure in the McAlpine pool, efforts in McAlpine were treated as an extension of the Control and Removal project. This report focuses on effort placed into the pools above Markland Lock and Dam

(Figure 1). All other removal effort below Markland Locks and Dam is reported in the 2016 Control and Removal of Asian Carp report. This was altered from removal conducted in 2015 in order to focus removal efforts in higher density pools were the largest impact could be made. Leading Edge efforts typically focused more on tagging fish for tracking purposes and some removal of fish that looked in too poor of a condition to tag along the invasion front. Some manual tracking was conducted in the Racine pool in 2015; however, manual tracking was not conducted in 2016 due to limited man-power.

Physical Removal of Asian Carps

Electrofishing and gill netting along the "leading edge" of invasion in 2016 were conducted for roughly 18 weeks from May – September. Electrofishing was not standardized, but total effort (hours) was recorded. Pulsed DC electricity at 40% duty-cycle and 80 pulses per second was used most often and voltage was adjusted to attain maximum power for each run. Large mesh (4.0" – 5.0") gill nets were used, with each set consisting of a minimum 180 minutes of soak time, while fish were driven toward nets with boat noise at 30-minute intervals.

Sampling sites focused on tributaries and embayments (mimicking site selection and protocols from lower pools) where densities of Asian carp were likely the highest and fish were easiest to capture. The majority of these locations were derived from monitoring sampling sites in 2015 and 2016. Some effort was expended to investigate additional sites that were either remotely identified through GIS and map study or contained features characteristic of typical carp habitat.

All Asian carps and by-catch were identified to species. All carp were inspected for tags (either jaw or ultrasonic VEMCO tags) before being euthanized for population control or tagged for the Ohio River Telemetry project. All by-catch was returned to the water. Asian carp species (bighead carp, silver carp, and grass carp) from each sampling location were measured for total length (in) and weight (lbs) to provide estimates of the minimum total weight harvested. When possible, supplemental data included a record of sex and a collection of aging structures (spines) for each silver or bighead carp captured (Williamson and Garvey 2005, Seibert and Phelps 2013). In addition to spines, some otoliths were taken for microchemistry analysis. These samples were sent to Dr. Gregory Whitledge Ph.D., Southern Illinois University, and are awaiting analysis.

Pursuit of Novel Capture Techniques

Several novel techniques were explored throughout the months of leading edge work in 2016. These efforts were intended provide basin partners with information on strategies and gears that may more effectively target carp for suppression in the future. This same information is covered in the Control and Removal of Asian Carp project it is not reported in detail here. The only alternative techniques used in the pools along the leading edge of invasion were winged hoop netting, sound herding, attractants and night electrofishing. A short description of each is provided below.

A four-foot, winged hoop net was purchased and modified with the intention of testing its utility when targeting Asian carp at known high-density locations. This gear was appealing due references citing its use when targeting bighead carp and because it could be left unmonitored for several days at a time. Hoop nets were fished over a 48-hour period on three separate occasions. Nets were set well below the surface in flow, with throat facing downstream, and the two 25-ft wings positioned to either side to act as a corral for fish swimming upriver towards the throat.

Night electrofishing was attempted on two occasions in RC Byrd where the presence of a group of bighead carp elicited an emergency response effort. An electrofishing boat was outfitted with four LED floodlights at the bow allowing the driver and dipper to navigate and capture fish in the dark. An additional floodlight was positioned at the stern of the boat for rear visibility and a spotlight could be used by the driver to visually investigate any objects outside of the of the floodlight range. Electrofishing was

not standardized, but total effort was recorded. Pulsed DC electricity at 40% duty-cycle and 80 pulses per second was used and voltage was adjusted to attain maximum power for each run.

Collaborative work between USGS, KDFWR, and USFWS was conducted using sound equipment and attractants in an effort to herd or congregate fish in low-density areas of the river during one week in the month of August. Gill nets were used to block off sections of a tributary into defined reaches. Then complex sound was applied in an effort to herd fish downstream towards an entanglement. In addition to using sound, an automatic feeder was set up in an attempt to congregate fish around the feeder for easier capture. No data was collected in association with the feeder's ability to increase densities of carp because the platform was destroyed during a storm.

Results:

Physical Removal of Asian Carps

A total of 34.98 hours were spent electrofishing in the four Ohio River pools and tributaries from Markland up through RC Byrd pool (Table 1). Ten carp totaling 195lbs were removed along the leading edge. The largest amount of electrofishing effort was expended in the Markland pool where seven silver carp and three grass carp made up the entirety of fish removed via boat electrofishing for this project. All other fish captured with electrofishing were tagged for the Telemetry of Asian Carp in the Ohio River project.

Gill netting totaled 8,135 ft of net fished to capture six bighead carp and one silver carp in the four pools along the leading edge (Table 2). The majority of effort was placed in Meldahl pool, where only one bighead carp was captured. Four bighead carp were captured by USFWS using gill nets in the RC Byrd pool after receiving reports of carp frequenting a tributary just upriver of Greenup Lock and Dam.

Pursuit of Novel Capture Techniques

Calculating capture efficiencies for novel techniques was not attempted due to variations in the gear, set characteristics, duration of application, and site characteristics. However, the total effort (hrs) used to employ each method was quantified, along with the resulting catch of targeted fish. In addition, by-catch from each technique was documented. A summary of this information can be found in Table 3 of the 2016 Control and Removal of Asian Carp in the Ohio River report.

Sound herding into net entanglements did not produce any carp captures. On one occasion in Eagle Creek (Meldahl pool), a tagged bighead carp was located near the mouth of the tributary using manual tracking. Nets were placed downstream of the fish and sound was applied in an attempt to move the fish closer to the net set. After sound application was finished, manual tracking revealed that the fish did not appear to have moved in the intended direction. Additional replications of this design were cut short by poor weather conditions and no conclusions about the utility of this technique could be made. Other novel techniques in these lower density pools did not produce many results.

Discussion:

Total captures of invasive bighead carps across all activities in the pools along the leading edge were low. While more detail will be provided in the 2016 report covering acoustic telemetry efforts in the ORB, it should be noted that some contributions were made to the 110 fish tagged in the pools between McAlpine and RC Byrd Locks and Dams during this time. To avoid redundancy, all information pertaining to those fish captured along the leading edge are included in a separate report for that project.

Overall, electrofishing seems slightly more effective for capturing carp in the low-density pools along the leading edge. Due to their lower numbers, electrofishing may be a better gear to utilized when seeking out groups of silver carp. Electrofishing allows for greater coverage when surveying for the presence of these fish than gill nets. Netting is often limited by the number of nets that can be deployed over a stretch

of river and the man-hours required to run and maintain them. However, boat electrofishing rarely yields bighead carp captures and nets remain the better choice when targeting these fish. It is important to mention that this work is conducted during the day, in warmer months of the year. Reports of greater success when targeting *Hypophthalmichthys spp*. at night and in cooler the months suggests that some gears may be more successful if when deployed during these times.

With reports of fish being seen above Greenup Locks and Dam, removal effort in the RC Byrd pool and tagging efforts in the Greenup pool are likely to increase. The four bighead carp caught in RC Byrd were euthanized because they had exceeded the verbally agreed-upon, exclusion point for tolerable upriver expansion. With dam passage being a main objective of the telemetry efforts in the Ohio River, a better understanding of the rate of passage will likely inform response activities and removal efforts in future leading edge projects. This was the first year where the leading edge project was separated from removal efforts. Tailoring this work to fit the needs of the basin is currently under discussion and will be important for future progress.

Recommendations:
A focus on suppression and containment of carp populations along the leading edge should guide the future progress of this project. It may be necessary to better structure activities in order to develop a response plan that defines pool-specific goals for halting upriver expansion of carp populations. Ideally, carp captured between Markland Lock and Dam and RC Byrd Lock and Dam should be tagged if possible before being euthanized in order to maintain and grow the number of tagged fish in lower density pools. Any Asian carp that move past the RC Byrd Locks and Dam should be targeted for removal.

Project Highlights:

- The Leading Edge project was separated from removal conducted in 2015.
- Work conducted along the leading edge still involves removal of carp, but places more focus into tagging fish below Greenup Locks and Dam.
- There is need of an upper boundary defining the exclusion point for tolerable upriver expansion. Currently, Asian carps above RC Byrd Lock and Dam are considered too far up the system and are targeted for removal.
- A total of 34.98 hours were spent boat electrofishing along with 8,135ft of gill net worked to remove 600lbs of Asian carps from the pools between Markland and RC Byrd Locks and Dams.
- Efforts to tag fish contributed to the 110 individuals surgically implanted with transmitters along the leading edge in 2016.
- Due to the lower numbers of invasive carps in these pools, electrofishing may be better utilized when seeking out groups of silver carp.
- Gill netting remains the more effective gear to use when targeting bighead carp.
- This was the first year where the Leading Edge project was separated from removal efforts in 2015 and a focus on suppression and containment of carp populations along the leading edge should guide future progress.

Literature Cited:

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Tables:

Table 1. Electrofishing effort (hours) and resulting removal of three species of Asian carp (number and weight) in four pools of the Ohio River during Asian carp Leading Edge efforts in 2016.

Pool	Electro Hours	Bighead Carp (N)	Silver Carp (N)	Grass Carp (N)	Total (N)	Bighead Carp (Lbs)	Silver Carp (Lbs)	Grass Carp (Lbs)	Total (Lbs)
RC Byrd	8.15	0	0	0	0	0	0	0	0
Greenup	2.67	0	0	0	0	0	0	0	0
Meldahl	9.68	0	0	0	0	0	0	0	0
Markland	14.48	0	7	3	10	0	106	89	195
Total	34.98	0	7	3	10	0	106	89	195

Table 2. Gill netting effort (ft) and resulting removal of three species of Asian carp (number and weight) in four pools of the Ohio River during Asian carp Leading Edge efforts in 2016.

Pool	Electro Hours	Bighead Carp (N)	Silver Carp (N)	Grass Carp (N)	Total (N)	Bighead Carp (Lbs)	Silver Carp (Lbs)	Grass Carp (Lbs)	Total (Lbs)
RC Byrd	1800	4	0	0	4	266	0	0	266
Greenup	900	0	0	0	0	0	0	0	0
Meldahl	3640	1	0	0	1	62	0	0	62
Markland	1795	1	1	0	2	53	24	0	77
Total	8135	6	1	0	7	381	24	0	405

Figures:

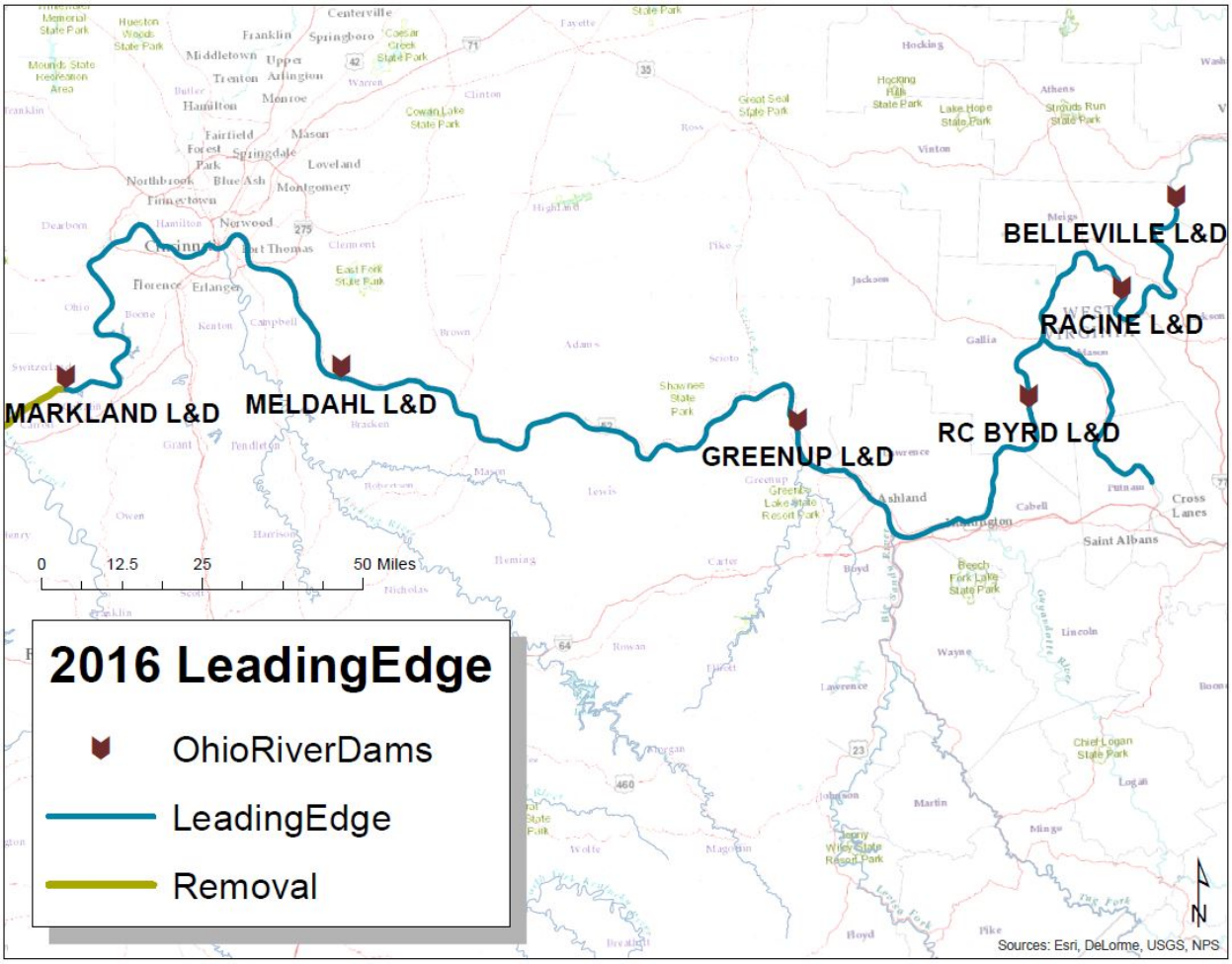

Figure 1. A map showing where Asian carp leading edge work was conducted in 2016. No effort was placed in the Racine pool in 2016; however, some manual tracking was conducted in 2015.