

JUVENILE ASIAN CARP MONITORING TO DOCUMENT GEOGRAPHIC RANGE OF RECRUITMENT OF ASIAN CARP IN THE UPPER MISSISSIPPI RIVER

Geographic Location: Upper Mississippi River Pools 14-19

Participating Agencies: La Crosse Fish and Wildlife Conservation Office (lead); Western Illinois University and Rock Island Ecological Services Field Office (field support).

Statement of Need:

Adult Bighead Carp (*Hypophthalmichthys nobilis*) and Silver Carp (*Hypophthalmichthys molitrix*) were first reported in the Upper Mississippi River basin above Lock and Dam 19 in 1987 and 1999, respectively (<http://nas.er.usgs.gov>), while Black carp (*Mylopharyngodon piceus*) have not yet been captured above Lock and Dam 22. The first Asian carp populations above LD 19 likely immigrated from source populations downriver. Commercial catch data from Illinois indicate that population densities have increased in recent years (Maher 2016). It is unknown whether reproduction and recruitment or immigration from downstream is driving population growth. In 2014, USGS ichthyoplankton tow samples containing *Hypophthalmichthys* eggs were found in pools 16, 17, 18, and 19 (Larson et al. 2017). Prior to 2016, the only evidence of successful recruitment is a handful of juvenile *Hypophthalmichthys* (<300 mm) reported in lower pool 19 (James Lamer, WIU, personal communication; Cari-Ann Hayer, USGS, unpublished data). In 2016, large numbers of juvenile Silver Carp were collected from pools 18 and 19. Understanding the source of population growth for these species will help direct Asian carp management actions in the UMR.

Project Objectives:

- 1) Determine the extent of Bighead Carp and Silver Carp recruitment above Lock and Dam 19.
- 2) Calculate relative abundance of Bighead Carp and Silver Carp in pools 16-19.

Project Highlights:

- In 2017, documented the upstream dispersal of juvenile Silver Carp to pool 16, documented a juvenile Bighead Carp in pool 19, and did not detect recruitment from a 2017 year class.
- In 2016, detected recruitment of Silver Carp as far upstream as pool 18 and Grass Carp in pool 17.

Methods:

Young-of-Year (YOY) sampling was initiated in August and extended through September in pools 14-19. Areas that provided what was suspected to be preferred habitat for juvenile Asian carp were sampled as targeted sites. A dozer trawl and boat electrofishing were used to sample backwaters, marinas, and tributary mouths. In August 2016, YOY Silver Carp captured in Pool 18 were 47 to 166 mm total length (\bar{x} =98 mm). The dozer trawl was used at the targeted sites in

August of 2017, when it was expected that small Asian carp would be at a size vulnerable to capture via trawl. The rigid frame of the dozer trawl measured 1.83 m wide by 0.91 m tall and the attached net was 35 mm mesh at the opening reducing to 4 mm at the cod end. The trawl was pushed from the front of the boat and the net extended 2.5 m under the boat. Length and duration of trawl was dependent on the site characteristics and available habitat. All fish were identified to species or genus and released.

Pulsed-DC boat electrofishing was used in September to target YOY that were potentially >100 mm. In September 2016 YOY Silver Carp averaged 164.5 mm total length(96-238 mm). The boat electrofisher was as 18 ft flat bottom boat with a Smith Root VVP-15B box set to pulsed-DC current at 60 pulses per second and 30% duty cycle. Temperature and conductivity corrections were made to produce a standard potential transfer of 3000 watts to the water. Electrofishing runs were 15 minutes in length and two netters collected fish. Power was turned off/on intermittently to prevent driving fish away from the effective electrified field. An attempt was made to net all fish that were observed. Non-target species were identified, counted, and released. Asian carp were measured, weighed, and transferred to WIU for collection of aging and microchemistry structures.

Abundance monitoring was conducted using pulsed-DC boat electrofishing with two dip netters in pools 16-18 during spring and fall. Multiple sites in each pool where Asian carp are known or expected to be present were selected as fixed sites. Random and alternate sites were selected for each pool using ArcGIS 10.4 at a minimum density of one site per 1.5 river miles. In the event a random site could not be reached, the nearest accessible alternate site was sampled. The same boat electrofisher that was used for YOY sampling was used for abundance sampling in pools 16-18. The box was set to pulsed-DC current at 60 pulses per second and 25-30% duty cycle. In pools 19-20, the boat electrofisher was a 20 ft flat bottom boat with an ETS box set to pulsed-DC current at 60 pulses per second and 25% duty cycle. Temperature and conductivity corrections were made to produce a standard potential transfer of 3000 watts to the water, per Long Term Resource Monitoring specifications (Gutreuter et al. 1995). Electrofishing runs were 15 minutes in length. Two netters attempted to dip all fish that were observed. All fish were counted and identified. Asian carp were measured and juveniles were transferred to WIU for collection of aging and microchemistry structures. Fixed site and random site catch per unit effort was averaged across each pool for the year.

Results and Discussion:

Targeted dozer trawling was completed during two weeks in August. Fifty trawling runs took place in pools 14-19 for a total of 13,920 meters trawled. There were 17,771 fish collected representing 23 species, although many smaller specimens were identified only to genus. No YOY Asian carp were observed or collected, although adults and larger juveniles were observed

at several locations. A subsample of Gizzard Shad measured to estimate size selectivity of the sampling gear averaged 59.4 mm total length (43-78 mm; n=45).

Targeted electrofishing was completed over two weeks in September. Forty-nine electrofishing runs were completed in pools 14-19 for a total of 12.3 hours of electrofishing. There were 15,609 fish collected representing 50 species and one hybrid. No YOY Asian carp were collected or observed. However, one juvenile Bighead Carp in pool 19 (520 mm), one juvenile Grass Carp in pool 18 (395 mm), and 43 Silver Carp were collected, 37 of which were juveniles (mean= 418.5 mm, range 385-470 mm) (Figure 1). Of the juvenile Silver Carp collected, four were in pool 17 [catch per unit effort (CPUE) = 2.29 juvenile Silver Carp/hour], six were in pool 18 (CPUE = 3.43), and 27 were in pool 19 (CPUE = 17.95) (Table 1).

Sixteen fixed sites and 99 random sites were sampled in April and October of 2017. A total of 13,523 fish representing 53 species and two hybrids were collected in pools 16-18. No Bighead Carp were collected. Four Silver Carp were collected at randomized sites including one juvenile in pool 16 (254 mm) and one juvenile in pool 18 (479 mm) (Table 1). One adult was collected in each of pools 16 and 17. Three juveniles were collected at one pool 18 fixed site and five adults were collected at one pool 17 fixed site (Table 1). Seven adult Grass Carp were collected: one in a pool 16 fixed site, one in a pool 16 random site, and five in pool 18 random sites.

In summary, 46,892 fish were collected at 215 sample sites through all gears combined (Table 2) (Figure 2). There were no YOY Asian carp collected. Fifty-five Silver Carp were collected, 42 of which were juveniles belonging to the 2016 year class. The 2016 year class, detected as far upstream as pool 18 during that year, was detected two pools upstream in pool 16 as a result of this monitoring. A 584 mm Silver Carp collected by Exelon biologists in pool 14 during fall of 2017 now represents the furthest upstream detection reported of a juvenile Silver Carp (James Lamer, WIU, Personal Communication). To our knowledge, the juvenile Bighead Carp collected in pool 19 represents the first and only juvenile of that species documented above Lock and Dam 19.

Recommendation: Continue to target YOY Asian carp during the summer months in backwaters, marinas, and tributary mouths with the dozer trawl and boat electrofishing.

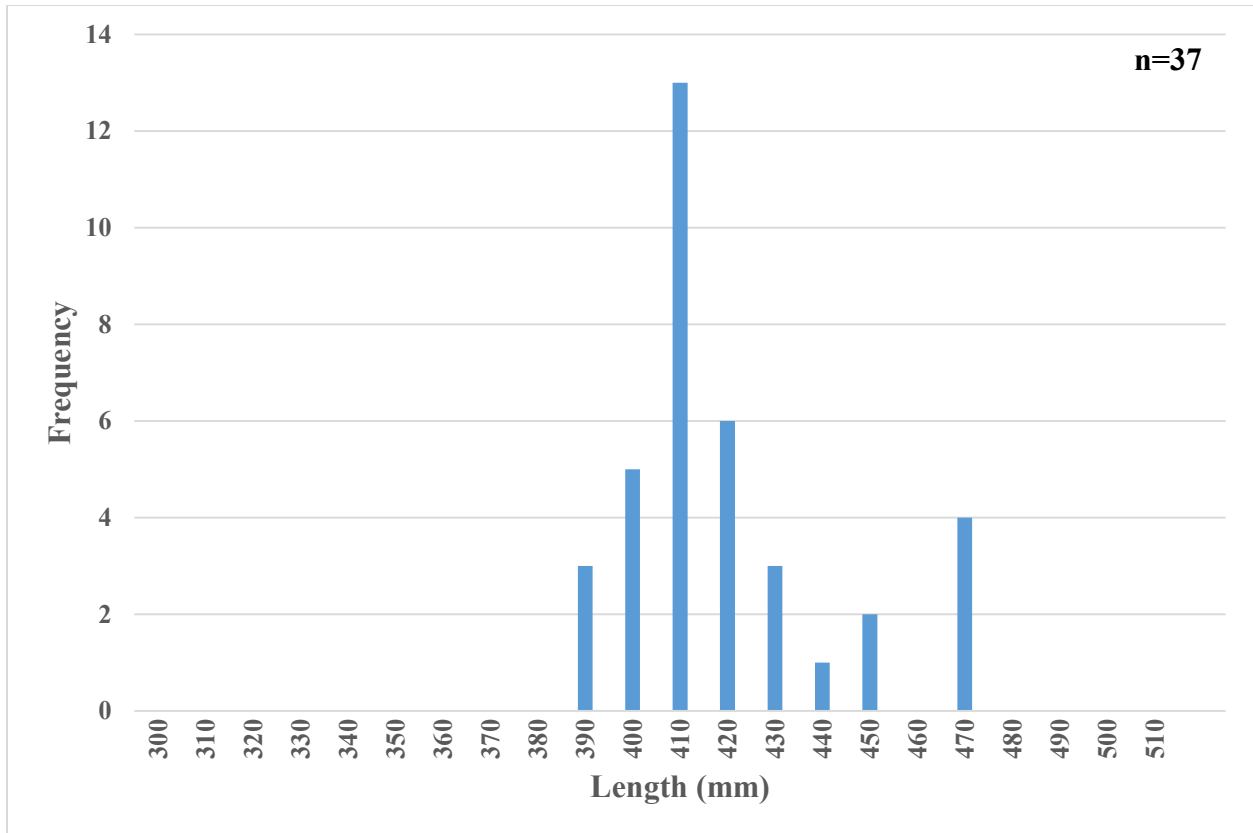


Figure 1. Length-frequency histogram of juvenile Silver Carp collected during targeted electrofishing sampling in pools 17-19.

Table 1. Juvenile Silver Carp collected via electrofishing by pool in 2017. CPUE is calculated as juvenile Silver Carp/hour of electrofishing.

	Targeted Electrofishing		Random Electrofishing		Fixed Electrofishing	
	Age 1 SVCP	CPUE	Age 1 SVCP	CPUE	Age 1 SVCP	CPUE
14	0	0.00				
15	0	0.00				
Pool 16	0	0.00	1	0.11	0	0.00
17	4	2.29	0	0.00	0	0.00
18	6	3.43	1	0.11	3	2.00
19	27	17.95				
Total	37	3.02		0.08	3	0.16

Table 1. Total catch with all gears by pool during 2017 juvenile Asian carp monitoring.

Common Name	Scientific Name	Pool						Total
		14	15	16	17	18	19	
Gizzard Shad	<i>Dorosoma cepedianum</i>	3,011	2,041	5,223	3,540	5,391	2,255	21,461
Emerald Shiner	<i>Notropis atherinoides</i>	44	159	3,439	2,699	4,808	843	11,992
Unidentified Shiner	<i>Notropis</i> spp.	969	1,296	1,509	1,509	154	1,240	6,677
Freshwater Drum	<i>Aplodinotus grunniens</i>	7	21	497	186	199	5	915
Bluegill	<i>Lepomis macrochirus</i>	92	113	76	153	149	157	740
Largemouth Bass	<i>Micropterus salmoides</i>	152	72	74	132	149	82	661
Common Carp	<i>Cyprinus carpio</i>	39	49	223	92	121	54	578
River Carpsucker	<i>Carpiodes carpio</i>	51	26	149	98	190	4	518
Brook Silverside	<i>Labidesthes sicculus</i>	44	80	27	19	23	96	289
Quillback	<i>Carpiodes cyprinus</i>	26	4	75	46	83	3	237
Bigmouth Buffalo	<i>Ictiobus cyprinellus</i>	4	7	51	61	59	38	220
White Bass	<i>Morone chrysops</i>	10	5	73	51	62	18	219
Unidentified Lepomis	<i>Lepomis</i> spp.			3	118	90		211
Smallmouth buffalo	<i>Ictiobus bubalus</i>	1	4	90	34	68	11	208
Orangespotted Sunfish	<i>Lepomis humilis</i>	7	5	63	11	62	23	171
Shortnose Gar	<i>Lepisosteus platostomus</i>			72	61	27	3	163
Walleye	<i>Sander vitreum</i>	17	1	36	26	33	2	115
White Crappie	<i>Pomoxis annularis</i>	3		22	22	56	9	112
Longnose Gar	<i>Lepisosteus osseus</i>	4	5	54	34	5	1	103
Channel Catfish	<i>Ictalurus punctatus</i>	2		48	23	17	5	95
Mooneye	<i>Hiodon tergisus</i>			67	20	2		89
Golden Shiner	<i>Notemigonus crysoleucas</i>	11	66	1	2	3	2	85
Shorthead Redhorse	<i>Moxostoma macrolepidotum</i>			43	11	31		85
Sauger	<i>Sander canadense</i>	3	4	45	13	18	1	84
Channel Shiner	<i>Notropis wickliffi</i>			3	30	30	20	83
Bowfin	<i>Amia calva</i>	13	3	12	9	16	18	71

Common Name	Scientific Name	Pool							Total
		14	15	16	17	18	19		
Unidentified Crappie	<i>Pomoxis</i> spp.					66		66	
Silver Carp	<i>Hypophthalmichthys molitrix</i>			2	11	10	32	55	
Black Crappie	<i>Pomoxis nigromaculatus</i>	4	2	5	8	12	18	49	
Highfin Carpsucker	<i>Carpiodes velifer</i>			32	12			44	
Sand Shiner	<i>Notropis stramineus</i>	27	9	1	2		1	40	
Silver Chub	<i>Macrhybopsis storeriana</i>			24	7	8	1	40	
Pumpkinseed	<i>Lepomis gibbosus</i>					40		40	
Spotfin Shiner	<i>Cyprinella spiloptera</i>	1		1	4	26	6	38	
Yellow Perch	<i>Perca flavescens</i>	8	25	1	2	2		38	
Northern Pike	<i>Esox lucius</i>	12	6	8	2	4	5	37	
River Shiner	<i>Notropis blennius</i>			7	19	3	3	32	
Bullhead Minnow	<i>Pimephales vigilax</i>		1	12	10	5	2	30	
Spottail Shiner	<i>Notropis hudsonius</i>	8	4	2	5	5	2	26	
Spotted Sucker	<i>Minytrema melanops</i>	7	10	1	2	2	1	23	
Yellow Bass	<i>Morone mississippiensis</i>			1	3	15		19	
Golden Redhorse	<i>Moxostoma erythrurum</i>	3		7	2	5		17	
Flathead Catfish	<i>Pylodictus olivaris</i>			5	4	2	1	12	
Silver Redhorse	<i>Moxostoma anisurum</i>	1		9		1		11	
Striped Bass x White Bass	<i>Morone saxatilis</i> x <i>M. chrysops</i>	2		5	1	3		11	
Smallmouth Bass	<i>Micropterus dolomieu</i>		3	2	3	2		10	
White Sucker	<i>Catostomus commersoni</i>				9			9	
Grass Carp	<i>Ctenopharyngodon idella</i>			2		6		8	
Warmouth	<i>Lepomis gulosus</i>				4	2	1	7	
Unidentified Chub	<i>Macrhybopsis</i> spp.	5		1				6	
Green Sunfish	<i>Lepomis cyanellus</i>	1			3		1	5	
Logperch	<i>Percina caprodes</i>	3	1	1				5	
Paddlefish	<i>Polyodon spathula</i>			3	1			4	

Common Name	Scientific Name	Pool						Total
		14	15	16	17	18	19	
Longear Sunfish	<i>Lepomis megalotis</i>				4			4
Johnny Darter	<i>Etheostoma nigrum</i>					3		3
Unidentified Redhorse	<i>Moxostoma</i> spp.	1		2				3
Shovelnose Sturgeon	<i>Scaphirhynchus platyrhynchus</i>			2				2
Goldfish	<i>Carassius auratus</i>			2				2
River Redhorse	<i>Moxostoma carinatum</i>					2		2
Northern Hog Sucker	<i>Hypentelium nigricans</i>					1		1
Black Buffalo	<i>Ictiobus niger</i>	1						1
Redear Sunfish	<i>Lepomis microlophus</i>					1		1
Skipjack Herring	<i>Alosa chrysochloris</i>	1						1
Silver Lamprey	<i>Ichthyomyzon unicuspis</i>						1	1
Brown Bullhead	<i>Ameiurus nebulosus</i>			1				1
Green Sunfish x Bluegill	<i>Lepomis cyanellus</i> x <i>L. macrochirus</i>			1				1
American Eel	<i>Anguilla rostrata</i>			1				1
Unidentified	Unidentified						1	1
Unidentified Sucker	Unidentified Catostomidae			1				1
Mimic Shiner	<i>Notropis volucellus</i>				1			1
Bighead Carp	<i>Hypophthalmichthys nobilis</i>						1	1
Total		4,595	4,022	12,117	9,119	12,073	4,977	46,892

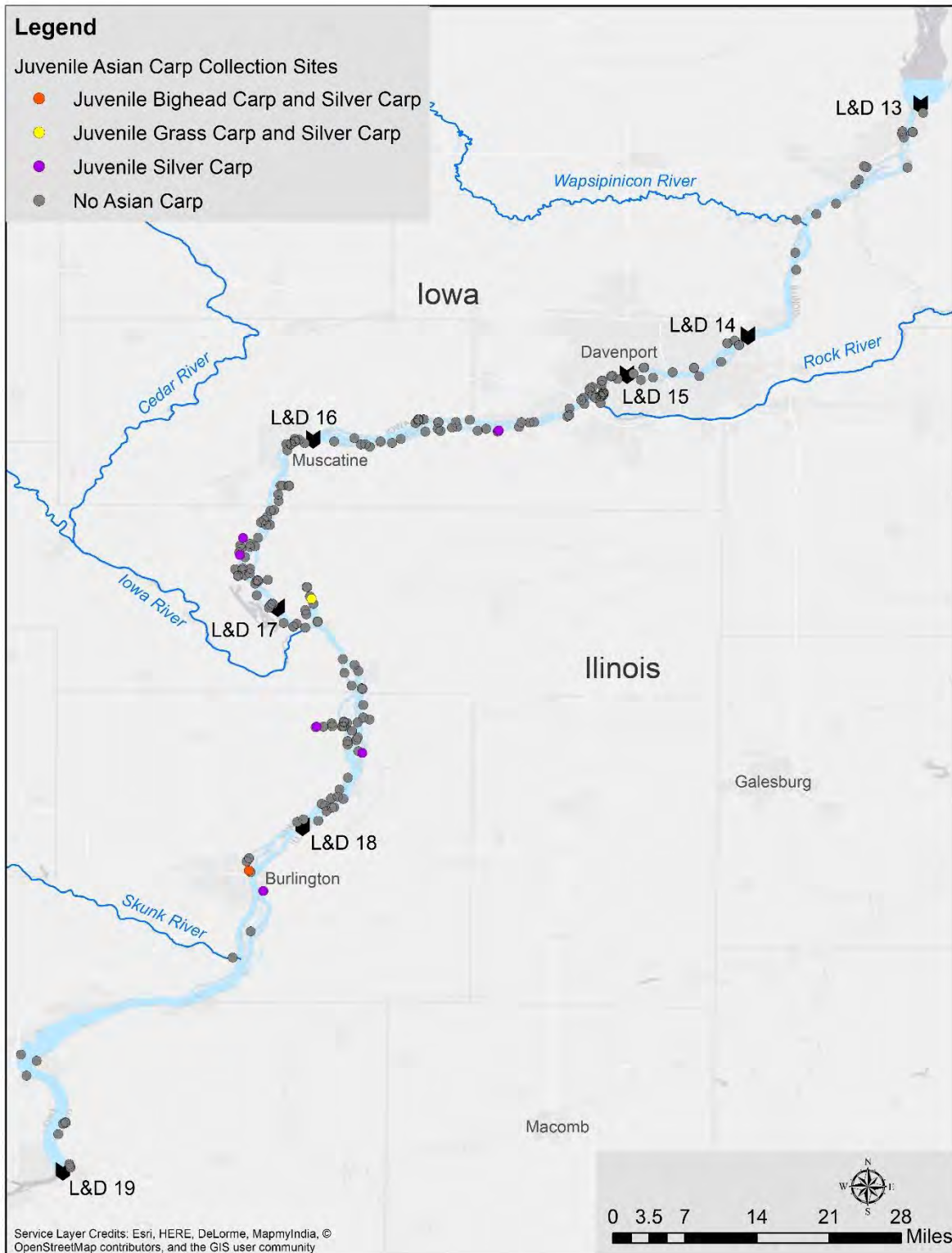


Figure 2. Sample sites for all gears in 2017 and locations where juvenile Asian carp were collected.

References Cited

- Gutreuter, S., R. Burkhardt, and K. Lubinski. 1995. Long Term Resource Monitoring Program Procedures: Fish Monitoring. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P002-1. 42 pp. + Appendixes A-J
- Larson, J. H., Knights, B. C., McCalla, S. G., Monroe, E., Tuttle-Lau, M., Chapman, D. C., George, A. E., Vallazza, J. M. and Amberg, J. (2017), Evidence of Asian Carp Spawning Upstream of a Key Choke Point in the Mississippi River. *North American Journal of Fisheries Management*, 37: 903–919.
- Maher, R. 2016. 2015 commercial catch report exclusive of Lake Michigan. Illinois Department of Natural Resources, Alton, IL.