



2019 Upper Mississippi River Asian Carps Egg and Larval Fish Monitoring Program

Geographic Location: Upper Mississippi River, Pools 8-13, La Crosse, Wisconsin to Clinton, Iowa

Participating Agencies: U.S. Fish and Wildlife Service La Crosse Fish and Wildlife Conservation Office

Point of Contact:

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Statement of Need:

Ichthyoplankton monitoring for the eggs and larva of Asian carps in the Upper Mississippi River (UMR) was deemed important by the UMRACT for timely detection of new spawning events in novel habitats. Researchers have expressed concern that the arrival of Asian carps in the UMR watershed will have cascading effects on local aquatic ecosystems. However, it appears that the success of Asian carps' spawning events may be highly contingent on environmental factors such as sustained, high river discharge during late spring and early summer (Kolar et al 2007; Camacho 2016). Understanding why production and recruitment may be limited in some years and in some locations may help managers to recognize bottlenecks in the life history of Asian carps caused by environmental variations and spur the development of new and effective management strategies for limiting their reproduction in unexploited habitats.

Project Objectives:

- 1) Evaluate Asian carp reproduction (egg, larval, and juvenile densities) in the UMR watershed. The goal of this USFWS-managed program is to establish a monitoring framework on Pools 8-13 of the Mississippi River and its largest tributaries: the Maquoketa, Turkey, and Wisconsin rivers. Researchers at Iowa State University (ISU) maintain a companion monitoring program to accomplish these objectives on Pools 14-20 of the Mississippi River and its tributaries: the Wapsipinicon, Rock, Iowa, Skunk, and Des Moines rivers.
- 2) Monitor larval fish and egg production of native fishes occurring in the watershed. Yearly monitoring of larval fish and egg drift in the UMR and its tributaries offers opportunities to explore the reproductive habits of fishes aside from Asian carps. These data can help establish a baseline, pre-invasion estimate of native fish production/recruitment in rivers where Asian carps have not yet established robust reproductive populations.

Project Highlights:

- All fishes collected during 2016 sampling were identified during Winter/Spring 2017. No Silver, Bighead, Grass, or Black carps were observed in 240 samples.
- All fishes collected during April-August 2017 sampling were identified during Summer/Fall 2018. No Silver, Bighead, Grass, or Black carps were observed in 306 samples.
- All fishes collected during May-August 2018 sampling were identified during Summer/Fall 2019. No Silver, Bighead, Grass, or Black carps were observed in 161 samples.



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Methods

Monitoring for Asian carp eggs and larvae using ichthyoplankton tows was conducted at 13 fixed-locations (Figure 1) approximately every 7-10 days from May until August 2018. During 2016 and 2017, 29 total sites were monitored. However, staff shortages during 2018 required a reduction in sampling effort. For the purposes of standardization, every effort was made to sample closest to the original sampling location throughout the summer. Sampling locations had to be relocated in some situations because of the growth of emergent vegetation that fouled the plankton nets. Ichthyoplankton tows using a 0.5 m diameter net with 500 μm mesh were conducted at the surface at a constant boat speed relative to the shoreline for four minutes at each location. A General Oceanics Model (2030R) flowmeter was mounted in the mouth of the net to estimate volume (m^3) of water filtered during each tow. The sites were arranged in groups of 2-3 tows to document habitat-specific variations in catch rates. Three tows were conducted at each mainstem Mississippi River sites parallel to river flow. The first tow was conducted in the main thalweg for drifting eggs and larvae, the second tow occurring near channel borders where water velocity is moving downstream slower than the thalweg, and the third in an adjacent backwater area for mobile larvae (>24 hours post fertilization). At each tributary location, one fixed sampling location was established inside the tributary $\sim 1\text{km}$ upstream of the confluence with the Mississippi River and another location was established along the main channel border of the Mississippi River $\sim 1\text{km}$ downstream of the tributary's confluence. After each tow, ichthyoplankton net contents were rinsed toward the cod end, placed in sample jars, and preserved in 95% non-denatured ethanol. The ethanol was replaced in each sample container after the first 24 hours of storage to further preserve samples for later genetic analyses (Kelso et al. 2012).

In the laboratory, eggs and larvae were separated from detritus, counted, and preserved for morphometric and, if necessary, genetic identification. Eggs were not identified but rather sorted into two size classes (<5 mm or ≥ 5 mm diameter) to determine those that were 'possible' Asian carps (≥ 5 mm). All larval fishes were identified to the lowest taxonomic level using Auer (1982) and Holland-Bartels et al. (1990) as the primary taxonomic keys. Family and genus level identifications occurred due to damaged individuals or the absence of practical ways of differentiating morphological similarities to the species or genus level. All fishes identified as 'possible' Asian carps using keys provided by Chapman (2006) and Chapman and George (2011) were immediately submitted to the Whitney Genetics Lab for genetic confirmation of species assignment. The developmental stage (yolk-sac, larval, or juvenile) and key characteristics (length, number of myomeres, and pigmentation pattern, among others) of all fishes were documented. Fish recognized as having a full complement of fins were categorized as juvenile fish. A minimum of 10% of processed samples underwent independent quality control (QC) procedures to validate the identifications.



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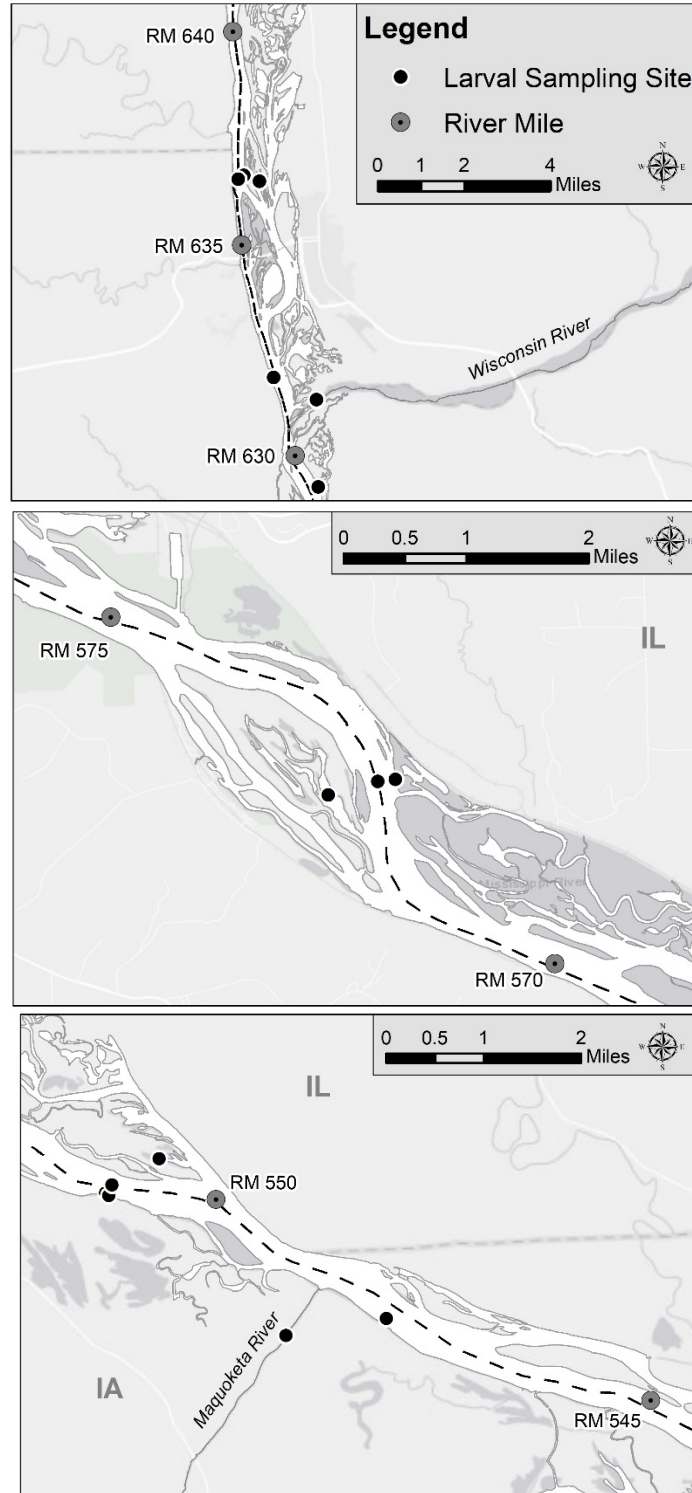


Figure 1. Map of ichthyoplankton netting locations in Navigational Pools 10, 12, and 13 of the Upper Mississippi River monitored during 2018. Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.



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Results and Discussion:

2018 Results

7,536 larval and juvenile fish and 1,333 eggs were collected in 157 of 161 ichthyoplankton tows conducted between 16 May and 21 August 2018. Laboratory processing of samples using visual identification methods, supported by genetic confirmation where necessary, of larval and juvenile fishes were completed in Summer/Fall 2019 and did not identify any Bighead, Silver, Grass, or Black carps in the samples. Table 1 provides information on the total catch identified to family. A monthly breakdown of catch statistics is provided in Appendix 1.

Table 1. Total catch of fishes from ichthyoplankton monitoring in two tributaries and Pools 10, 12, and 13 of the Upper Mississippi River during 2018. Specimens were identified to family.

<u>Family</u>	<u>Number Identified</u>
Catostomidae	195
Centrarchidae	1,144
Clupeidae	772
Cyprinidae*	4,313
Hiodontidae	1
Lepisosteidae	1
Moronidae	179
Percidae	64
Percopsidae	1
Sciaenidae	831
Unknown	35

*Family Cyprinidae did not include any Bighead, Silver, Grass, and Black carps

Recommendation:

While the results of our initial survey indicate that Asian carps did not reproduce in Pools 8-13 of the UMR during 2016-2018, we believe that future surveys may be necessary in these pools given the evidence of sporadic production and recruitment documented in Silver and Bighead Carp from the Illinois River (Gibson-Reinemer et al. 2017) and the Upper Mississippi River (Camacho 2016). We also recommend that these data on Asian carp production be incorporated into more complex, watershed-scale analyses of Asian carp population dynamics and movement patterns (Rahel and Jackson 2007). If Asian carp eggs or larvae are detected, specialized spacial analyses could help regional managers more precisely determine the times and locations of Asian carp spawning events and the destinations of drifting eggs and larvae (e.g. Hightower et al. 2012, Garcia et al. 2013). This information, in turn, could be used to direct novel control strategies that both target adult Asian carp and limit successful spawning events or early life-stages growing in nursery habitats.



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References:

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Appendix 1. Summary of 2018 taxonomic identifications by taxa, month sampled, and life stage.

Family	Genus	Species	Common name	May 2018			June 2018			July 2018			August 2018		
				# YSL	# Larvae	# Juveniles	# YSL	# Larvae	# Juveniles	# YSL	# Larvae	# Juveniles	# YSL	# Larvae	# Juveniles
			Number of samples collected ¹												
Carostomidae			Suckers	17	2	-	-	1	-	1	1	-	-	-	-
	Ictiobus or carpiodes		Buffalo fish or suckers	5	14	-	-	3	-	1	-	-	-	-	-
	Ictiobus		Buffalo fish	10	21	-	-	-	-	-	-	-	-	-	-
	Carpiodes		Suckers	2	66	1	28	7	1	-	-	-	-	-	-
	Carostomus		Commonsori	-	1	-	-	-	-	-	-	-	-	-	-
Centrarchidae			White Sucker	-	1	-	-	-	-	-	-	-	-	-	-
			Sunfishes	7	1	-	-	-	-	3	-	-	1	-	-
	Lepomis		Common sunfishes	15	337	-	-	112	-	42	-	-	98	-	-
	Lepomis	macrochirus	Bluegill	-	222	-	-	150	25	1	82	1	36	1	-
	Lepomis	gibbosus	Pumpkinseed	-	-	-	-	2	-	-	3	-	-	-	-
	Pomoxis		Crappies	-	4	-	-	-	-	-	-	-	-	-	-
	Pomoxis	nigromaculatus	Black crappie	-	1	-	-	-	-	-	-	-	-	-	-
Clupeidae			Herrings	-	-	-	-	-	-	-	-	-	-	-	-
	Dorosoma	cepedianum	Gizzard shad	2	168	-	-	594	8	-	-	-	-	-	-
Cyprinidae			Carp and minnows	2	10	-	-	10	-	5	45	-	2	3	-
	Notropis		Eastern shiners	10	1	-	11	21	1	9	13	-	5	10	-
	Notropis	atherinoides	Emerald shiner	5	644	-	31	665	8	-	262	2	-	1,165	-
	Notropis	hudsonius	Spot-tail shiner	3	64	-	5	81	-	8	118	-	4	734	-
	Cyprinus	carpio	Common carp	126	27	-	112	24	-	44	9	-	8	6	-
Hiodontidae			Mooneyes	-	-	-	-	-	-	-	-	-	-	-	-
	Hiodon	tergisus	Mooneye	-	-	-	1	-	-	-	-	-	-	-	-
Lepisosteidae			Cars	-	-	-	-	-	-	-	-	-	-	-	-
	Lepisosteus	osseus	Longnose Car	-	-	-	-	1	-	-	-	-	-	-	-
Moronidae			Temperate basses	-	-	-	-	-	-	-	-	-	-	-	-
	Morone		Temperate basses	3	167	-	-	6	3	-	-	-	-	-	-
Percidae			Perches and darters	-	-	-	1	-	-	-	-	-	-	-	-
	Percia	flavescens	Yellow Perch	8	52	-	-	2	-	-	-	-	-	-	-
	Percina	caprodes	Logperch	-	1	-	-	-	-	-	-	-	-	-	-
Percopsidae			Trout-Perches	-	-	-	-	-	-	-	-	-	-	-	-
	Percopsis	omniscomaycus	Trout-perch	-	1	-	-	-	-	-	-	-	-	-	-
Sciaenidae			Drums and croakers	-	-	-	-	-	-	-	-	-	-	-	-
	Aphodinotus	grunniens	Freshwater Drum	30	50	-	9	633	88	4	4	-	13	-	-
			Unknown	2	15	-	-	6	-	-	8	-	-	-	-
			Eggs < 5 mm diameter (non-Asian carp)		1,333			0			0			0	
			TOTAL (Not including eggs)	247	1,869	1	198	2,318	139	74	591	3	38	2,057	1