Project Title: Suppression of Bighead Carp in the Neosho River-Grand Lake System

Geographic Location: Neosho River – Grand Lake system.

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Participating Agencies: Oklahoma Department of Wildlife Conservation (ODWC) and Missouri State University (MSU).

Statement of Need: Introduced invasive carps (Bighead Carp, Black Carp, Grass Carp, and Silver Carp) have become established in many portions of the Mississippi River Basin (Jennings 1998; Kolar et al. 2005). The feeding habits and population densities of invasive carps cause significant ecological harm where populations become established (Schrank et al. 2003; Irons et al. 2007; Sampson et al. 2009; Solomon et al. 2015; Phelps et al. 2017). The resulting diminished opportunity for fishing (recreational and commercial), boating, and other wildlife-associated recreation causes significant negative economic impact.

Bighead carp have been occasionally captured by anglers and fisheries managers within the Neosho River – Grand Lake system. This population of bighead carp represents the only known population of either species of bigheaded carps in the United States to be potentially reproducing in a reservoir system completely isolated from other source populations. Pensacola Dam does not have a lock or other structure that allows for upstream migration into the Neosho River – Grand Lake system from downstream. In addition, there are two more dams downstream of Pensacola Dam (Kerr Dam and Ft. Gibson Dam) that further separate this Neosho River-Grand Lake bighead carp population from bighead carp in the Arkansas River. Resource managers are concerned that without suppression efforts that the Neosho River – Grand Lake system, as well as other invasive carp-free downstream waters, could experience the negative ecological and economic impacts documented at other locations infested with invasive carps. As the Neosho River – Grand Lake bighead carp population currently appears to be low density, there exists an opportunity to conduct management and suppression efforts now to prevent future damages.

This situation of an isolated and potentially reproducing bighead carp population provides a unique opportunity to learn about invasive carp and test and develop methods for removal or suppression of invasive carp in a reservoir system. Reservoir fisheries are incredibly important recreationally and economically in the United States. As invasive carp spread and move upstream in Mississippi River tributaries and congregate below reservoir dams, the risk of introduction of invasive carp into reservoirs (presumably through bait collection activities below dams that result in fish being released above dams) increases as does the need to learn more about how to manage invasive carp populations in reservoirs.

Very little targeted sampling of bighead carp had occurred in the Neosho River – Grand Lake system in either Kansas or Oklahoma prior to a project previously funded by FWS in FY 20 titled “Distribution and Population Demographics of Bighead Carp in the Neosho River-Grand Lake System to Inform Removal”. The objectives of that project were to:

- Identify locations of presence and upstream extent of bighead carp population within the Neosho River – Grand Lake system.
- Collect baseline population demographic information including relative abundance, age and growth, and size structure.
- Determine broadscale movements within the Neosho River system using otolith microchemistry.
- Identify locations within the Neosho River – Grand Lake system for containment, removal, and/or eradication efforts.

KDWP looks to build upon this previous work. The focus moving forward is to encourage and conduct suppression of bighead carp through removal with a goal of preventing bighead carp from becoming more numerous and problematic in the Neosho River – Grand Lake system and downstream waters. These suppression efforts support Goal 3 of the Lower Mississippi River Basin Invasive Carp Control Strategy Framework to: "Reduce invasive carp densities with the ultimate goal of extirpation of invasive carps" as well as Goal 1 to: "Stop the introduction and population expansion into basin waters that do not contain invasive carps".

Project Objectives:

1) Suppress bighead carp within the Neosho River – Grand Lake system by removing invasive carp.

Project Highlights:

- 75 bighead carp (3-4 times the total number of carp collected over the last 32 years) were captured and removed from the Neosho River – Grand Lake system in 2023.
- Awareness of bighead carp, their impacts, and ongoing management/suppression efforts in this system was greatly increased among, and supported by, fishing guides, anglers, and the public.
- Live imaging sonar technology has proven an effective tool for finding and removing large bighead carp in this low-density system.
- The information gathered from these suppression efforts is being used to inform the ongoing, FWS funded, bighead carp telemetry project in this system, which will in turn help direct future suppression efforts.

Methods:

KDWP worked closely with ODWC and MSU to coordinate and plan suppression of bighead carp in the Neosho River – Grand Lake system as informed by findings from the previous FWS funded carp project in this system. KDWP purchased removal equipment (multiple net types in particular) and employed staff to remove and coordinate efforts to remove or encourage removal of bighead carp. Additionally, based on findings from the previous projects, expert fishing guides utilizing live imaging sonar technology were identified as a potentially effective method of bighead carp removal in this low-density system. As such KDWP, contracted with a fishing guide, Bryan Baker, through MSU, to remove bighead carp. Fish captured by Bryan Baker and others were provided to ODWC and demographic data was obtained.

Results and Discussion: This project is the result of an ongoing and evolving multi-agency collaborative efforts to fill knowledge gaps and manage and suppress bighead carp across the Neosho River-Grand Lake system. Newly emerging forward-facing sonar technology has allowed anglers to locate, track, and target individual fish. Anglers and guides have been utilizing and perfecting this technology to snag Paddlefish *Polyodon spatula*. Large Bighead Carp possess a unique and distinctive shape and are identifiable using this technology (Figure 3.). With encouragement and collaboration with KDWP, ODWC, and MSU, guides and anglers successfully collected and reported 75 Bighead Carp during 2023.

Currently, bighead carp range appears to be limited to Grand Lake and the lower Neosho River. Otolith microchemistry results from the previous project suggest large broadscale movements and potential movement into the Spring River and age estimates and preliminary data from 2023 snag captures suggest multiple year classes. Bighead carp in the system are generally large, old and fecund but likely exist in relatively low abundances. Individual bighead carp were tested by ODWC and all were reproductively viable (i.e., diploid). Upstream movement and expansion are likely dictated by low-head dams and environmental conditions. A large portion of snagged carp were captured around low-head dams. While reproduction was never documented, fish were often observed displaying spawning-like behaviors (B. Baker, Spoonbill Wreckers, personal communication). Improving technology and snagging techniques may be the most efficient and effective means of capture.

Bighead carp range appears somewhat limited and likely present in relatively low abundances. However, large fecund individuals and evidence of multiple year classes suggest successful reproduction is possible. Control and suppression may be feasible given the relatively low abundances and limited range. Continued collaboration with anglers and guides is imperative in targeting and removing bighead carp.

Tables and Figures:

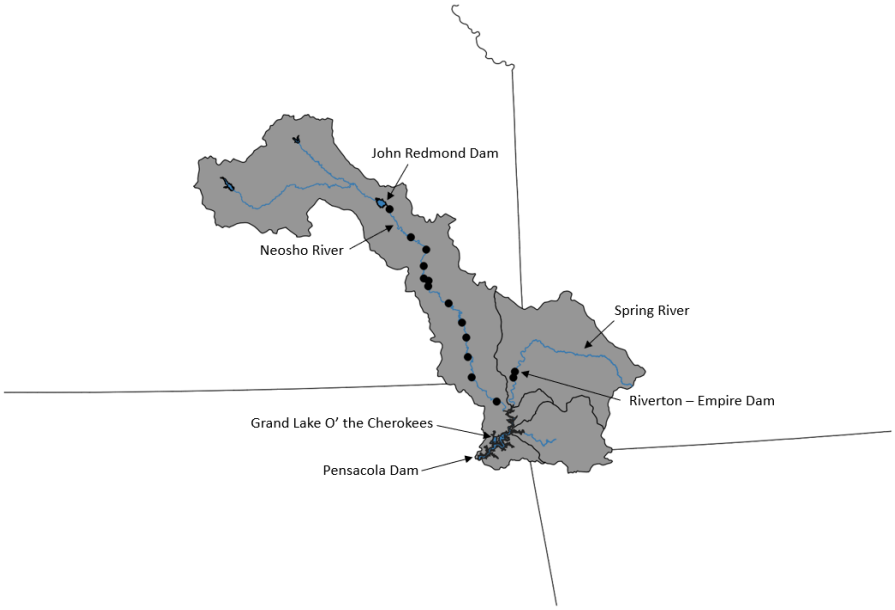


Figure 1. *Map of project area (unlabeled dots indicate lowhead dam location).*

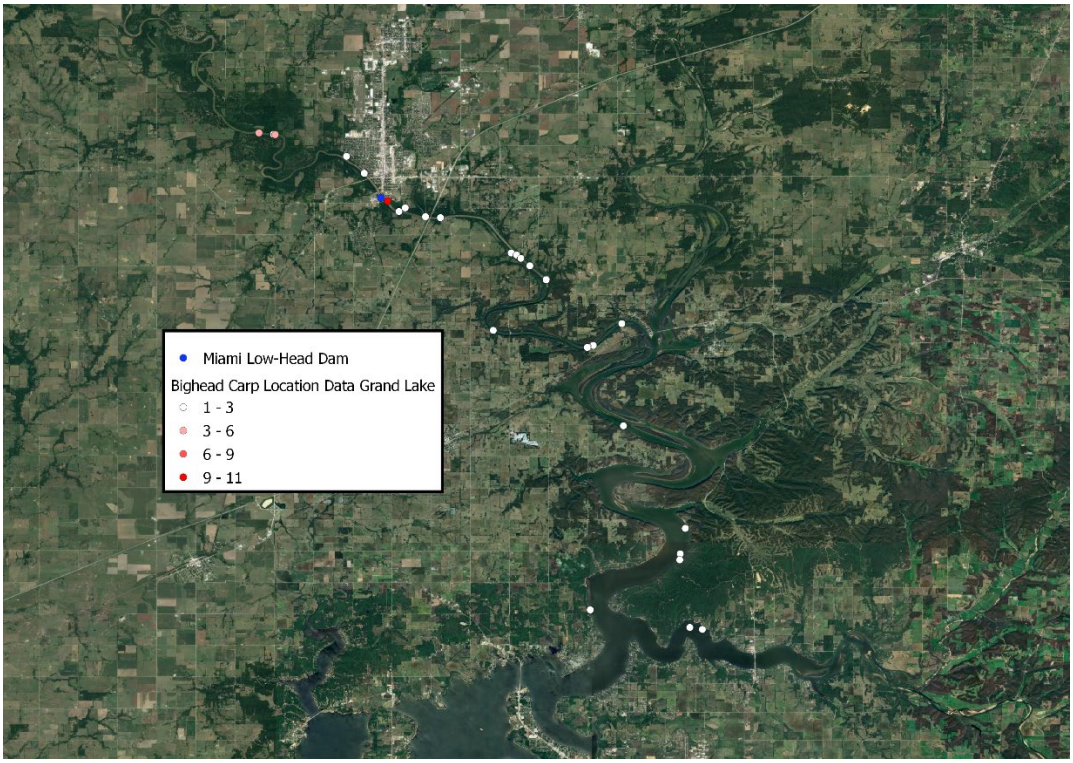


Figure 2. *Bighead carp capture locations in Neosho River – Grand Lake system in 2023.*

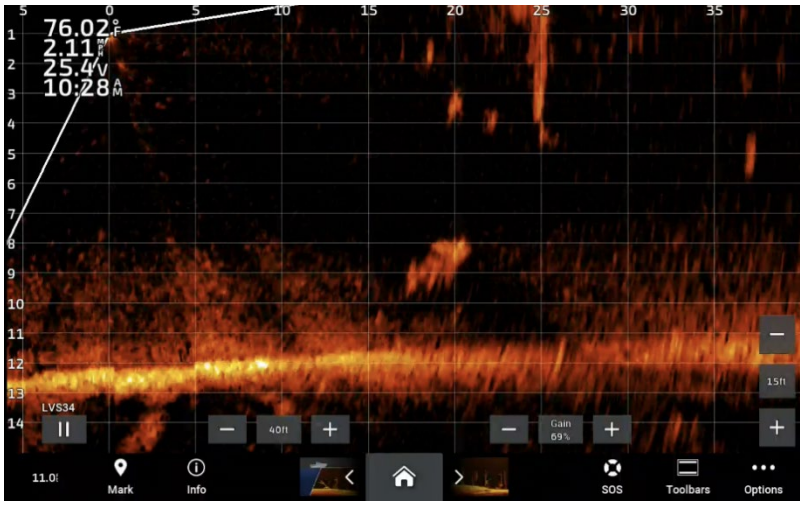


Figure 3. *Picture of live imaging sonar technology showing a clearly identifiable bighead carp. This equipment is being effectively used by anglers and fishing guides to target and capture bighead carp.*



Figure 4. *Examples of bighead carp captured in the Neosho River – Grand Lake system in 2023.*

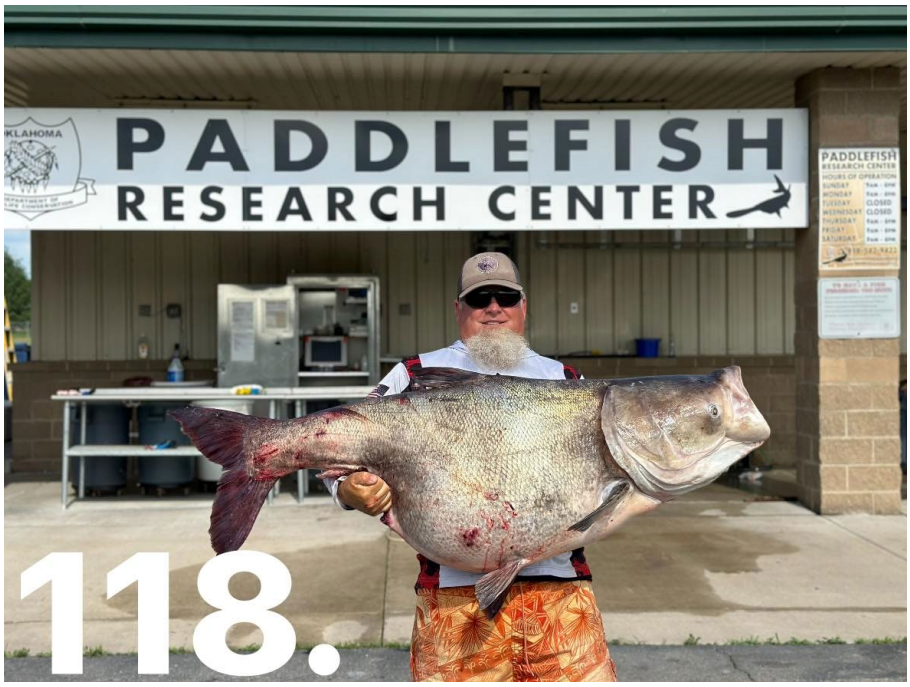


Figure 5. *The largest bighead carp captured in the Neosho River – Grand Lake system in 2023 was 118lbs 3oz and was caught by collaborator and fishing guide Bryan Baker. The fish was certified as the Oklahoma state record and to is also likely the largest bighead carp caught on rod and reel anywhere in the world.*

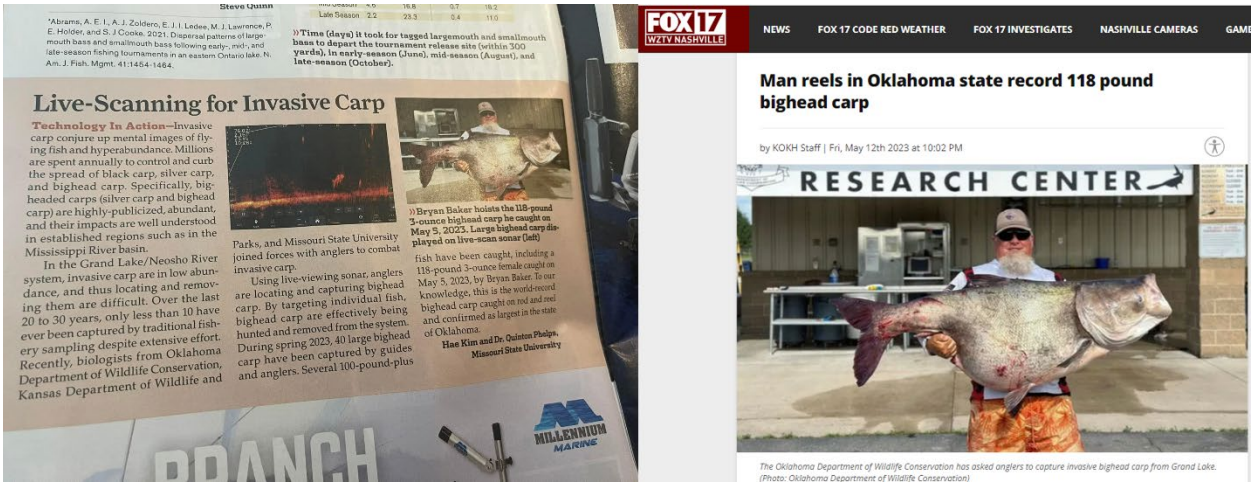


Figure 6. *The 118 lb. 3 oz. record bighead carp generated substantial interest in the bighead carp in the Neosho River – Grand Lake system and received considerable media coverage regionally and nationally.*

Table 1. Summary of catch and demographic data for bighead carp captured and removed from the Neosho River – Grand Lake system in 2023.

Date	Length (mm)	Weight (kg)	Sex
3/4/2023	1251	29.2	M
3/28/2023	1319	28.9	M
4/3/2023	1310	33.1	M
4/16/2023	1314	32.1	M
4/23/2023	1280	31.1	M
4/27/2023	1351	36.7	M
4/29/2023	1378	49.9	F
4/29/2023	1304	36.7	M
4/30/2023	1334	42.7	F
4/30/2023	1330	39.0	M
5/3/2023	1280	29.2	M
5/5/2023	-	-	-
5/5/2023	-	-	-
5/5/2023	-	-	-
5/5/2023	-	-	-
5/6/2023	1117	29.3	M
5/6/2023	1357	40.6	F
5/6/2023	1247	25.5	M
5/6/2023	1305	34.0	M
5/6/2023	1406	48.0	F
5/7/2023	1261	29.3	M
5/7/2023	1309	27.3	M
5/8/2023	1235	31.1	M
5/9/2023	1378	44.6	F
5/10/2023	1387	53.6	F
5/10/2023	1255	31.7	M
5/10/2023	1332	33.2	M
5/11/2023	1060	26.7	M
5/11/2023	1421	46.1	F
5/11/2023	1426	49.3	F
5/11/2023	1254	29.8	M
5/11/2023	1179	31.9	M
5/11/2023	1222	26.4	F
5/11/2023	1117	27.6	M
5/11/2023	1181	26.4	M
5/11/2023	1471	54.1	F
5/11/2023	1161	30.2	M
5/11/2023	1405	51.1	F
5/12/2023	1092	21.1	M
5/12/2023	1409	42.7	F
5/12/2023	1414	46.9	F
5/13/2023	1293	42.7	F

5/13/2023	1450	51.3	F
5/13/2023	1386	44.8	F
5/13/2023	1304	43.2	F
5/17/2023	1250	45.4	F
5/22/2023	1338	33.8	F
5/28/2023	1334	30.3	F
5/31/2023	1431	49.3	F
5/31/2023	1330	35.6	F
5/31/2023	1385	40.1	F
6/1/2023	1352	43.3	F
6/1/2023	1279	39.5	F
6/1/2023	1242	31.9	F
6/1/2023	1451	50.2	F
6/1/2023	1269	38.6	F
6/4/2023	1330	41.1	F
6/4/2023	1237	31.6	F
6/4/2023	1357	31.8	M
6/7/2023	1325	28.8	M
6/7/2023	1037	19.7	M
6/7/2023	1333	47.4	F
6/7/2023	1433	48.7	F
6/11/2023	1254	30.8	M
6/11/2023	1220	27.9	M
6/11/2023	1195	38.1	F
6/11/2023	1157	26.8	M
6/19/2023	1415	41.3	F
6/20/2023	1365	33.2	M
6/20/2023	1290	34.0	M
6/21/2023	1349	32.9	M
6/24/2023	1174	33.1	M
6/28/2023	1244	29.0	M
6/28/2023	1181	26.6	M
12/13/2023	1031	22.0	M
Total bighead carp captured:	**75**	**Bighead carp captured by Bryan Baker:**	**61**

Recommendations: Continue and expand efforts to suppress bighead carp in the Neosho River – Grand Lake system. Continue outreach and awareness efforts to encourage capture and removal of bighead carp among anglers, especially fishing guides, that are rapidly acquiring and learning live imaging sonar technology that can be used to target bighead carp. Continue working, collaborating, and contracting with the most effective fishing guides to maximize capture of bighead carp in the Neosho River – Grand Lake system. As important knowledge gaps relating to

bighead carp seasonal and habitat use in this system remain, it is important to integrate information learned in the upcoming telemetry project in this system into suppression efforts.