

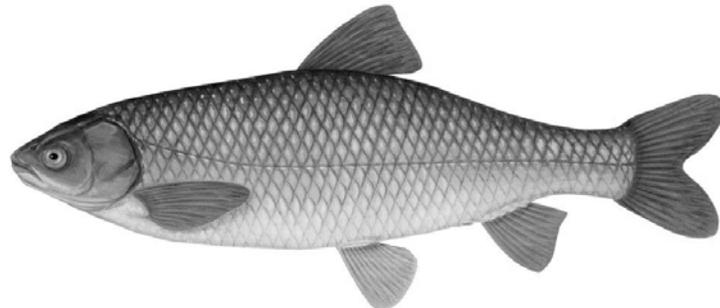
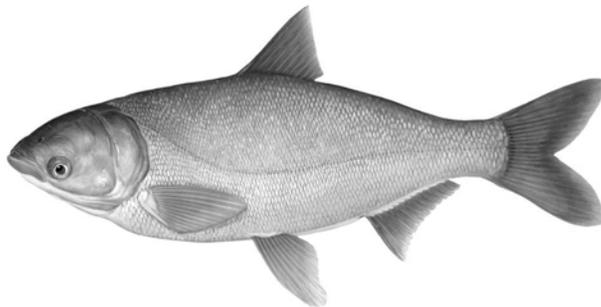
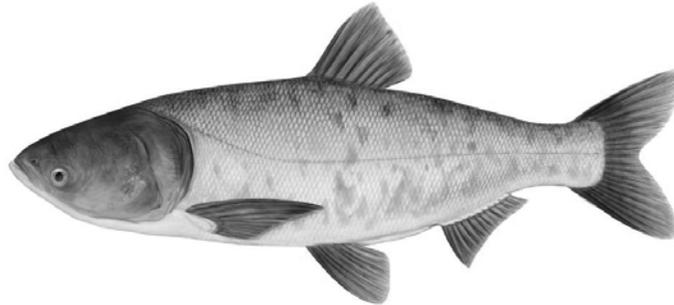
INVASIVE CARP SAMPLING REPORT

JUNE – DECEMBER 2012

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

DIVISION OF FISH AND WILDLIFE

SECTION OF FISHERIES



UPPER MISSISSIPPI RIVER, POOL 2

LOWER ST. CROIX RIVER, BELOW ST. CROIX FALLS

March 14th, 2013



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INTRODUCTION

Bighead *Hypophthalmichthys nobilis* and silver *H. molitrix* carp (hereafter referred to as Invasive Carp) were introduced into the United States during the early 1970's as aids in fish aquaculture operations (Henderson 1976). Subsequently, large flood events allowed these carp to escape into the Mississippi River drainage, where they began reproducing and spreading (Freeze and Henderson 1982). Invasive Carp have migrated up the Mississippi River, and adjoining tributaries, quickly establishing populations in newly invaded areas. In Minnesota, individual bighead carp have been collected as far north as Lake St. Croix, near Prescott, WI, and silver carp have been found as far north as Pool 6 of the Mississippi River, near Winona, MN. Currently, there is no evidence of Invasive carp reproduction in Minnesota waters.

Invasive Carp have the potential to devastate local ecosystems by competing with native planktivores and overcrowding other native species. With high fecundity and an ability to populate new areas quickly, Invasive Carp can reach high abundances, sometimes making up most of the fish biomass in certain systems (MICRA 2002). Invasive Carp have a voracious appetite, and coupled with their large size (>70 lbs.), they have the ability to consume large amounts of food by filtering zooplankton, phytoplankton, and organic particles out of the water column (Jennings 1988; Smith 1989; Voros 1997). If Invasive carp populations establish in Minnesota, native planktivores such as paddlefish *Polyodon spathula*, bigmouth buffalo *Ictiobus cyprinellus*, gizzard shad *Dorosoma cepedianum* may, and the larval stages of many other fishes may be in direct competition with Invasive Carp for food resources. Evidence from the Illinois River, Illinois, suggests that competition with Invasive Carp resulted in reduced condition factors for bigmouth buffalo and gizzard shad (Irons et al. 2007). Worldwide, introductions of Invasive Carp have led to declines in fish species diversity and abundances of commercially desirable species (Spatura and Gophen 1985; Petr 2002).

With the continuing progression of Invasive Carp up the Mississippi River, Minnesota waters are threatened by a potential invasion. A better understanding of the current status of Invasive carp individuals or populations in Minnesota will allow for more efficient efforts of preventing their spread and/or eradicating them if populations do exist. Standard fish sampling assessments have been ongoing in Minnesota's major rivers, and these surveys have the potential to catch Invasive Carp. However, the gears and methods used in these assessments are not the most efficient methods for capturing Invasive Carp. To date, Invasive Carp in Minnesota have only been caught by commercial fisherman. The purpose of this sampling effort is to use gears more specific to Invasive Carp to monitor all life stages of Invasive Carp and associated native fishes in the Mississippi River Pool 2 and the Lower St. Croix River.

OBJECTIVES

- Detect and monitor Invasive Carp of all life stages.
- Monitor native fish species that may be affected by the establishment of Invasive Carp.

SAMPLING SITES

Navigational Pool 2 of the Mississippi River spans approximately 52 km from Lock and Dam 1 in St. Paul, MN to Lock and Dam 2 near Hastings, MN. The section of the St. Croix River we focused on is just over 83 km long and spans from the dam near Taylors Falls, MN to the confluence with the Mississippi River near Prescott, WI.

SAMPLING METHODS

Gears, methods, and habitats where sampling was focused were derived from a collection of personal communications with biologists who have been sampling Invasive Carp (V. Santucci,

Illinois Department of Natural Resources, personal communication; J. Lamer, Western Illinois University, personal communication) and conducting research on the most efficient gears to sample Invasive Carp (M. Diana, Illinois Natural History Survey, personal communication), along with a variety of literature that included sampling techniques and habitat preferences (Lohmeyer and Garvey 2009; Williamson and Garvey 2005; Dettmers et al. 2001; DeGrandchamp et al. 2007; Kolar et al. 2007; DeGrandchamp et al. 2008; Wanner and Klumb 2009; ACRCC 2012). Sampling information for Invasive Carp that is included in this report took place between June 13, 2012 and December 31, 2012.

Fish Tagging Efforts

Currently several species of fish in the Mississippi River Pool 2 and the St. Croix River are part of ongoing tagging studies and when encountered they were tagged according to study guidelines. These species included flathead catfish *Pylodictis olivaris* and channel catfish *Ictalurus punctatus* in Pool 2 and lake sturgeon *Acipenser fulvescens*, muskellunge *Esox masquinongy*, flathead catfish, and channel catfish in the St. Croix.

Gill and Trammel Netting

Gill netting and trammel netting occurred during multiple sampling events on each system. Large mesh gill nets of depths from 8 to 14 ft. and lengths of 150 to 300 ft. with square mesh sizes of 4 to 6 in. were used to target adult Invasive Carp. Trammel nets with outside wall square mesh sizes of 14 in. and inner square mesh sizes of 4 in. were also used to target adult Invasive Carp. Experimental gill nets 250 ft. in length and 6 ft. deep consisting of 50 ft. compliments of net with square mesh sizes 0.75, 1, 1.25, 1.5, 2 in. were used to target juvenile Invasive Carp. Nets were set either short term or overnight, with short term sets favored when water temperatures were greater than 60° F. All fish caught were identified and measured.

Catch-per-unit-effort (CPUE) per 1000 feet of net was calculated for each net, and averaged across nets.

Commercial Fishing

Commercial fisherman were contracted to target Invasive carp with both gill nets and seines. Minnesota Department of Natural Resources (MNDNR) personnel accompanied contracted commercial fisherman to direct sampling locations and monitor efforts. Number of fish caught by species was recorded during gill netting operations and total weight harvested was requested from the commercial fisherman for both gill netting and seining operations.

Hoop Netting

Hoop netting was conducted during 3 separate sampling events. Several different sized hoop nets were used. Large 4 ft. diameter “buffalo” nets consisted of 9 tapered steel hoops and three throats, with a tapered mesh size of 3 in. sq. mesh at the mouth, 2 in. sq. mesh in the middle, and 1.5 in. sq. mesh at the cod end. The 3 ft. diameter hoop nets consisted of 7 tapered steel hoops and two throats, with either 1 in. or 2 in. sq. mesh throughout. All fish sampled were identified and measured. CPUE per net night was calculated for each net, and averaged across nets.

Trap Netting

Trap netting was only conducted during one sampling event on Pool 2. Trap nets consisted of a double frame (36 in. x 72 in.), 5 hoops (30 in.), two throats, and a 40 ft. lead, with a square mesh size of 0.75 in. throughout. All fish were identified and enumerated in the field.

Electrofishing

Electrofishing occurred in a variety of habitats including backwaters, side channels, main channel borders, and over wing dikes. Sampling locations consisted of random sampling sites in

the aforementioned habitats at the discretion of the sampler. At random sampling sites, most observed fish were identified in the water and only those needed for tagging were collected. This reduced unnecessary processing time and allowed for greater sampling effort.

RESULTS AND DISCUSSION

Sampling Results

In total, 53 days were spent sampling between June and December 2012 on the Mississippi River Pool 2 and St. Croix River with gears appropriate for sampling Invasive Carp (Table 1). A greater amount of effort was focused on Pool 2 (Figure 1), because Invasive Carp have not been found above Lock and Dam 2 on the Mississippi River. Determining whether there were individuals or populations of Invasive Carp in Pool 2 was of high importance. No Invasive Carp were collected in either Pool 2 or the St. Croix River during this sampling effort. With the results from this sampling effort, it is not possible to conclude that no Invasive Carp are present in these systems. However, this increased sampling effort decreases the likelihood that populations of Invasive Carp do exist in these systems and reinforces assumptions that Invasive Carp previously caught in the area were only wandering individual adults. Although no Invasive Carp were collected, bycatch from the additional sampling yielded information on several native fishes and gears that may be best suited for sampling Invasive Carp. Effort was expended by MN DNR personnel to monitor contracted commercial fisherman targeting adult Invasive Carp and to sample for various life stages of Invasive Carp with MNDNR gear by gill and trammel netting, electrofishing, hoop netting, and trap netting (Table 1).

Table 1. Invasive Carp sampling summary for the Mississippi River Pool 2 and the St. Croix River for June through December 2012.

**Invasive Carp Sampling Summary
June – December 2012**

	Measure	Unit
Total Number of Days Sampled	53	days
<i>MNDNR Sampling Effort</i>		
Gill/Trammel Netting	20,400	feet
Electrofishing	2,890	minutes
Hoop Netting	113	net/nights
Trap Netting	10	net/nights
Targeted Commercial Fishing Effort		
Gill Netting	39,400	feet
Seining	1	haul
Number of Invasive Carp Captured	0	fish

Gill nets and trammel nets set by MNDNR personnel were often used to sample behind wing dikes and in smaller side channel and backwater areas where it wasn't feasible for commercial fisherman to target with their larger operations. Most net sets were short term sets (2-5 hrs.) and a total of 20,400 feet of gill and trammel nets were set in Pool 2 and the St. Croix River (Table 1). Smallmouth buffalo *Ictobius bubalus* (43.4%, by number) were the most abundant fish caught in gill and trammel nets, followed by flathead catfish (17.9%), channel catfish (16.9%), and common carp *Cyprinus carpio* (11.7%, Figure 2). Insights into gear efficiency were observed during these sampling events. Of the gill and trammel nets set by MNDNR personnel, the trammel nets produced the highest CPUE of "Invasive carp like" fish (Figure 3). Our categorization of "Invasive carp like" fish included those that were similar to adult Invasive Carp in size, morphology and/or behavior and included the following: common carp, buffalo spp., and carpsucker spp *Carpoides spp*. In comparison, the gill netting conducted by the contracted commercial fisherman had CPUE's almost 3 times greater than trammel netting, owing to the utility of using commercial fisherman to search for Invasive Carp (Figure 3).

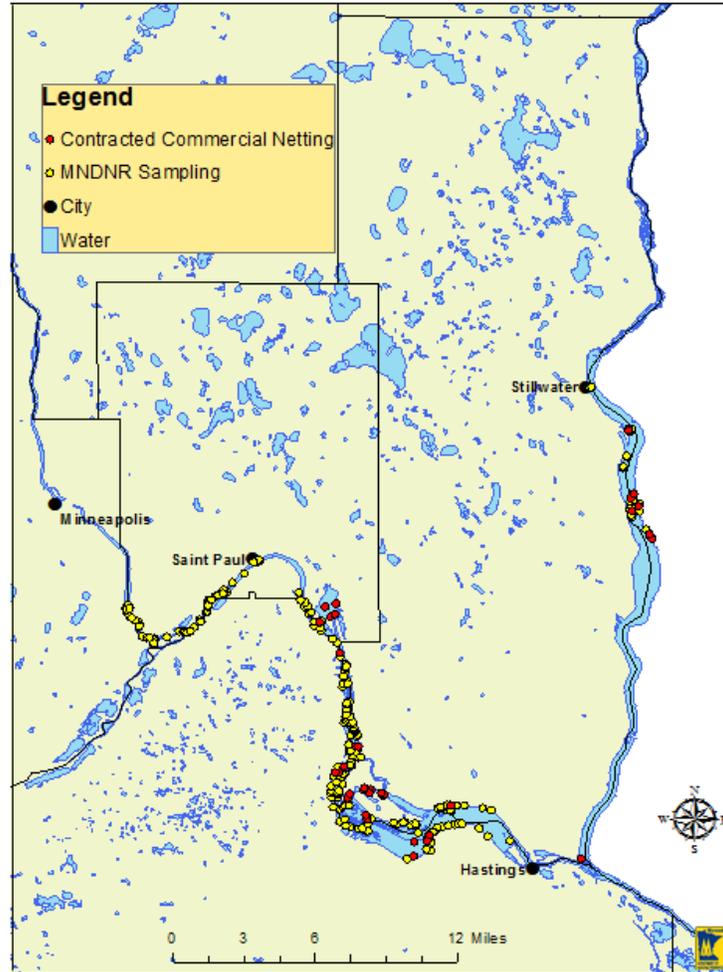


Figure 1. All sampling locations for contracted commercial netting and MN DNR sampling on the Mississippi River Pool 2 and the St. Croix River during 2012.

Contracted commercial fisherman ran 34,000 feet of gill net during 7 days of effort and conducted one seine haul between June and December 2012. Gill nets were set short term (2-3 hours) and fish were chased towards the net with boats, typically in large backwater areas. Smallmouth buffalo dominated the gill net catch, making up 55.6% of the catch (by number), followed by common carp (26.0%) and bigmouth buffalo (12.1%, Figure 4). The commercial fisherman harvested a total of 25,004 lbs. of fish during the 8 days of effort (Figure 5).

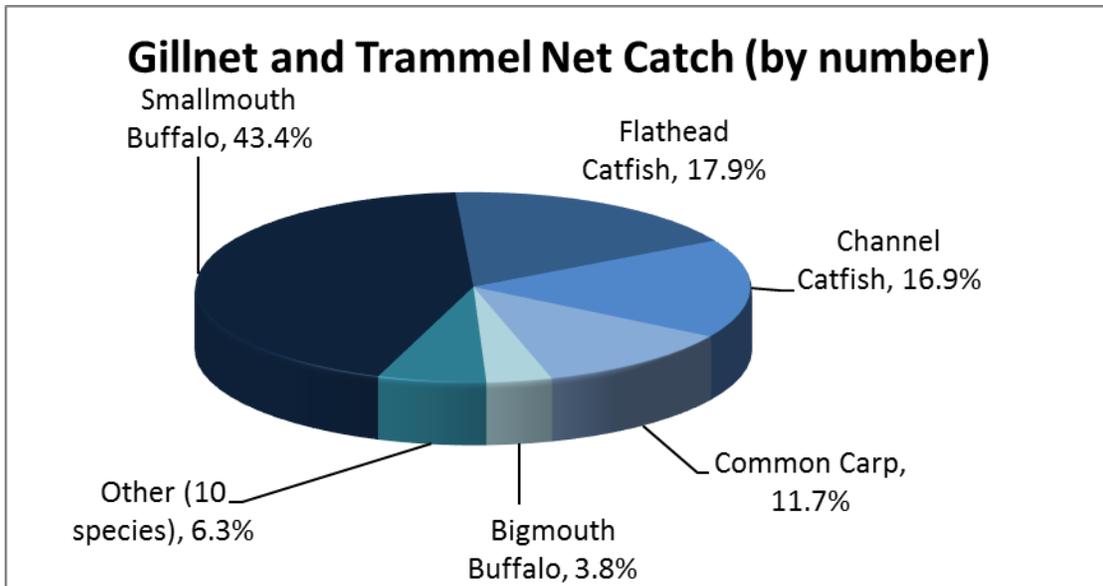


Figure 2. The percent catch by number of all fish caught in MNDNR gill and trammel nets on the Mississippi River Pool 2 during 2012.

Hoop nets of varying sizes were typically set in side channel and main channel habitats with at least some flow. Hoop netting effort totaled 113 net nights and channel catfish (29.7%, by number) dominated the hoop net catch, followed by black crappie (15.7%), common carp (14.0%), freshwater drum (13.3%) and smallmouth buffalo (11.5%, Figure 6). Insights into gear efficiency were also observed during hoop netting. The “buffalo” style hoop nets had the highest CPUE for all fish and for “Invasive carp like” fish (Figure 7). The large “Buffalo” style hoop nets may be the best style of hoop nets to use for targeting Invasive Carp.

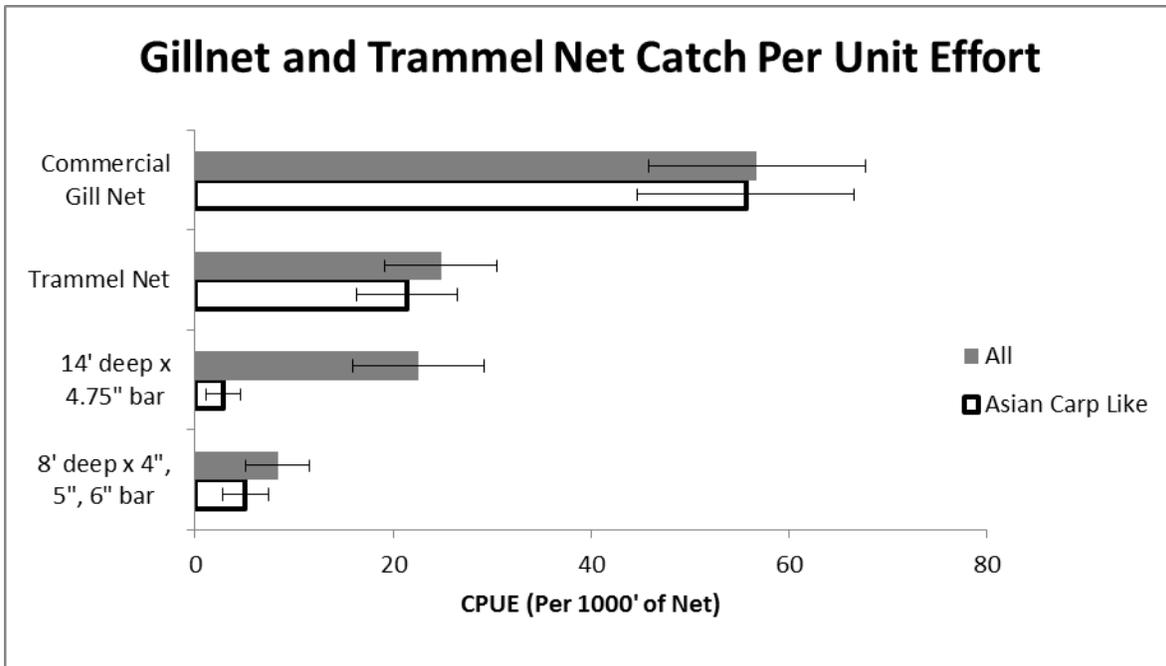


Figure 3. Catch-per-unit-effort (per 1000' of net) for all fish and for fish similar to adult Invasive Carp in size, morphology, and/or behavior (Invasive carp like) for four different types of gill and trammel nets from the Mississippi River Pool 2 and St. Croix River during 2012. Error bars equal one standard error.

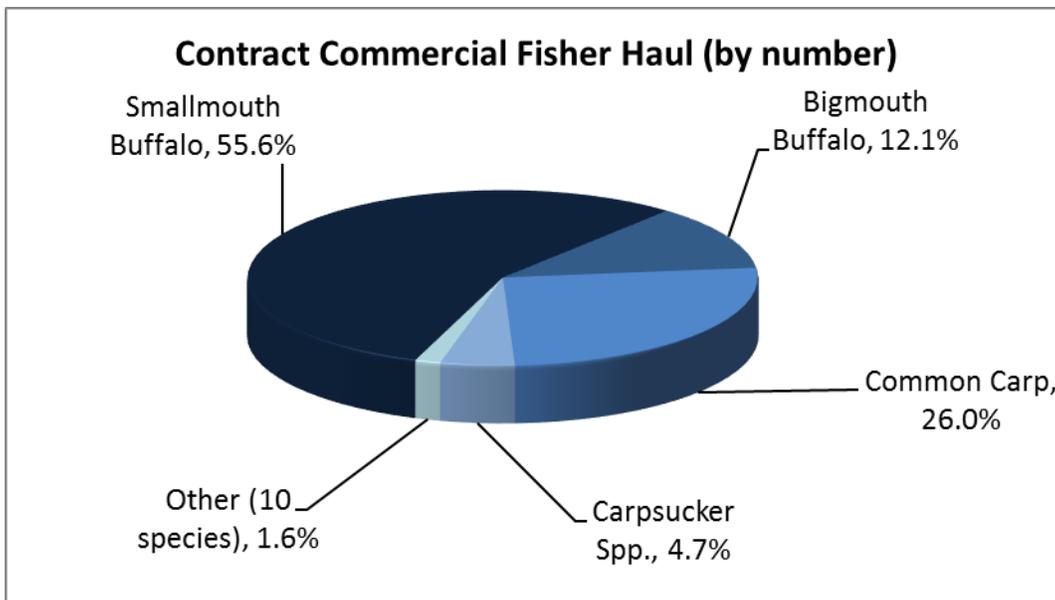


Figure 4. The percent catch by number of all fish caught using gill nets during contracted commercial fishing efforts on the Mississippi River Pool 2 and the St. Croix River during 2012.

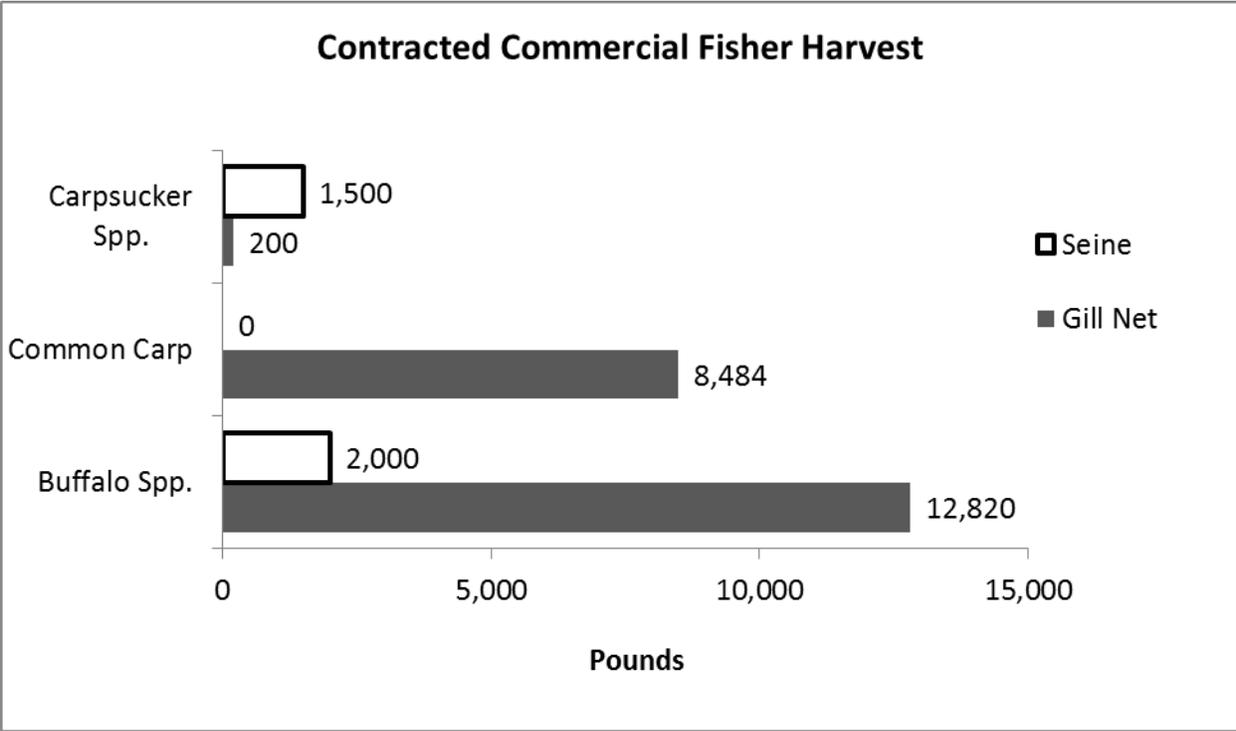


Figure 5. The reported harvest from contracted commercial fisherman on the Mississippi River Pool 2 and the St. Croix River during 2012.

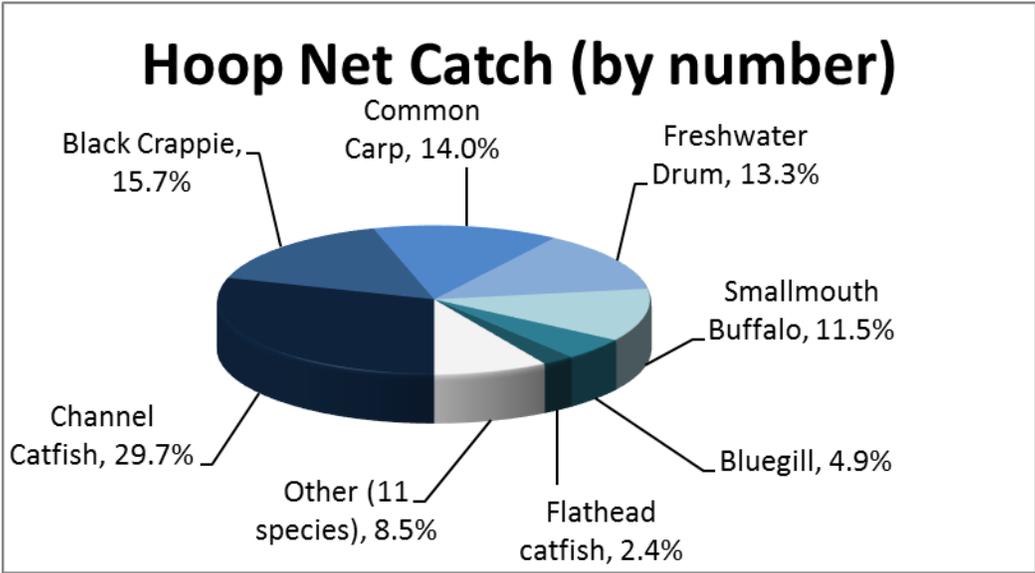


Figure 6. The percent catch by number of all fish caught in hoop nets on the Mississippi River Pool 2 during 2012.

Numerous other unique or rare native fishes worth mentioning were encountered during these sampling events. A shovelnose sturgeon *Scaphirhynchus platyrhynchus* captured and released by Lilydale, MN, was the first record in Pool 2 and weighed 7.45 lbs., almost 2 pounds heavier than the current state record. Numerous blue suckers *Cycleptus elongates* and several paddlefish, goldeyes *Hiodon alosoides*, mooneyes *Hiodon tergisus*, and an American eel *Anguilla rostrata* were also observed in Pool 2. A smallmouth buffalo captured and released on Pool 2 near downtown St. Paul measured 31.6 in. and was only 1/3 inch shorter than the length of the current state record.

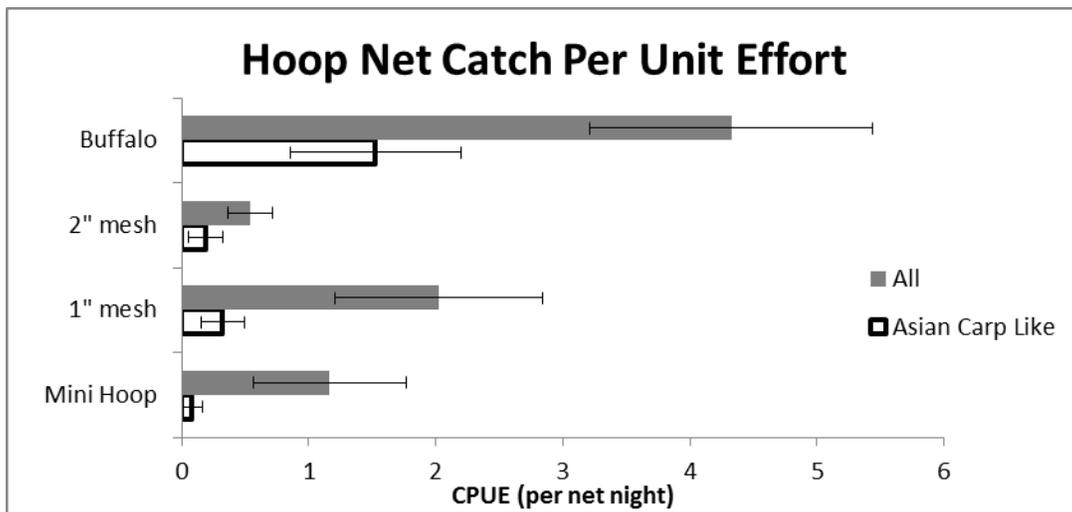


Figure 7. Catch-per-unit-effort (per net night) for all fish and for fish similar to adult Invasive Carp in size, morphology, and/or behavior (Invasive carp like) for four different types of hoop nets from the Mississippi River Pool 2 during 2012. Error bars equal one standard error.

RECOMENDATIONS

Acquiring additional gears to more effectively sample for various life stages Invasive Carp is recommended. Larval push trawls and mini-fyke nets are recommended to target larval and juvenile Invasive Carp, respectively. Also, gill nets with mesh sizes of 3.5” to 4” may be

better suited for targeting adult Invasive Carp, along with nets of varying depths (e.g. up to 24' deep) would allow sampling of the entire water column in additional locations.

Additionally, an age and growth analysis is recommended for native planktivores, such as bigmouth buffalo and gizzard shad, which may be in direct competition for food resources with Invasive Carp. Age and growth analysis on other native species such as smallmouth buffalo and freshwater drum that are commercially important is also recommended. In some states, current Invasive carp population control efforts include increasing commercial fishing effort to try and decrease Invasive carp abundance. This increased effort may likely affect native species as well and we would benefit from a greater understanding of the population dynamics of our commercially important native fishes.

Paddlefish are another native planktivore that may directly compete for food resources with Invasive Carp and therefore may be negatively affected. Currently, paddlefish are a state threatened species in Minnesota, and populations across their range have suffered due to commercial navigation projects impeding movement and altering habitats, pollution, and over exploitation (Jennings and Zigler 2000). If Invasive Carp become established in Minnesota rivers, local paddlefish populations would be further stressed. Being a state threatened species, a non-lethal means of studying paddlefish populations is also recommended. An additional report outlining the sampling methods for 2013 will also be completed.

REFERENCES

- ACRCC (Asian Carp Regional Coordinating Committee). 2012. Monitoring and rapid response plan for Asian carp in the Upper Illinois River and Chicago Area Waterway System. Monitoring and Rapid Response Workgroup, Asian Carp Regional Coordinating Committee, Council on Environmental Quality. Washington. May 2012.
<<http://asiancarp.us/documents/2011Framework.pdf>>
- DeGrandchamp, K. L., J. E. Garvey, and L. A. Csoboth. 2007. Linking adult reproduction and larval density of invasive carp in a large river. *Transactions of the American Fisheries Society* 136:1327-1334.
- DeGrandchamp, K. L., J. E. Garvey, and R. E. Colombo. 2008. Movement and Habitat Selection by Invasive Asian Carps in a Large River. *Transactions of the American Fisheries Society* 137:45-56.
- Dettmers, J. H., D. H. Wahl, D. A. Soluk, and S. Gutreuter. 2001. Life in the fast lane: Fish and foodweb structure in the main channel of large rivers. *Journal of the North American Benthological Society* 20:255-265.
- Freeze, M., and S. Henderson. 1982. Distribution and status of the bighead carp and silver carp in Arkansas. *North American Journal of Fisheries Management* 2:197-200.
- Henderson, S. 1976. Observations on the bighead and silver carp and their possible application in pond fish culture. Arkansas Game and Fish Commission, Little Rock.
- Irons, K. S., G. G. Sass, M. A. McClelland, and J. D. Stafford. 2007. Reduced condition factor of two native fish species coincident with invasion of non-native Asian carps in the Illinois River, U.S.A. Is this evidence for competition and reduced fitness? *Journal of Fish Biology* 71 (Supplement D):258-273.
- Jenning, D. P. 1988. Bighead carp (*Hypophthalmichthys nobilis*): a biological synopsis. U.S. Fish and Wildlife Service, Biology Report 88:1-35.
- Jennings, C. A., and S. J. Zigler. 2000. Ecology and biology of paddlefish in North America: historical perspectives, management approaches, and research priorities. *Reviews in Fish Biology and Fisheries* 10:167-181.
- Kolar, C. S., D. C. Chapman, W. R. Courtenay, Jr., C. M. Housel, J. D. Williams, and D. P. Jennings. 2007. Bigheaded carps: a biological synopsis and environmental risk assessment. American Fisheries Society, Special Publication 33, Bethesda, Maryland.

- Lohmeyer A. M. and J. E. Garvey. 2009. Placing the North American invasion of Asian carp in a spatially explicit context. *Biological Invasions* 11:905-916.
- MICRA. 2002. Asian carp threat to the Great Lakes. *River Crossings: The Newsletter of the Mississippi Interstate Cooperative Resource Association* 11:1-2.
- Petr, T. 2002. Cold water fish and fisheries in the countries of the high mountain arc of Asia (Hindu Kush-Pamir-Karakoram-Himalayas): a review. *In Cold Water Fisheries in the Trans-Himalayan Countries*, eds. Petr, T. and Swar, D. B., pp. 1-38. FAO Fisheries Technical Paper 431.
- Smith, D. W. 1989. The feeding selectivity of silver carp, *Hypophthalmichthys molitrix* Val. *Journal of Fish Biology* 34:819-828.
- Spatura, P., and M. Gophen. 1985. Feeding behaviour of silver carp *Hypophthalmichthys molitrix* Val. and its impact on the food web in Lake Kinneret, Israel. *Hydrobiologia* 120:53-61.
- Voros, L. 1997. Size-selective filtration and taxon-specific digestion of plankton and algae by silver carp (*Hypophthalmichthys molitrix* Val.). *Hydrobiologia* 342:223-228.
- Wanner, G. A., and R. A. Klumb. 2009. Asian carp in the Missouri River: Analysis from multiple Missouri River habitat and fisheries programs. National Invasive Species Council materials. Paper 10.
- Williamson, C. J., and J. E. Garvey. 2005. Growth, fecundity, and diets of newly established silver carp in the Middle Mississippi River. *Transactions of the American Fisheries Society* 134:1423-1440.