

Control and Containment of Invasive carp in the Ohio River

Geographic Location: Ohio River basin, extending from the Racine Lock and Dam (RM 237.5) to the Mississippi River (RM 0), including the Wabash River.

Participating Entities: Kentucky Department of Fish and Wildlife Resources (KDFWR), Illinois Department of Natural Resources (ILDNR), Indiana Department of Natural Resources (INDNR), and West Virginia Department of Natural Resources (WVDNR)

Introduction:

The complete eradication of an established invasive species is an extremely difficult task on its own, but it becomes virtually impossible to accomplish without causing collateral damage to native populations. Therefore, the best option for reducing the spread of an invasive species may include the combination of a strong prevention effort and a swift response to any possible introductions. After as many as four different species of invasive carp (Silver, Bighead, Grass, and Black Carp) were introduced into a major US waterway, resource managers made numerous attempts to prevent them from expanding into other areas. Despite these efforts, the ranges of all four invasive carp species have still increased since their introduction (Kolar et al. 2005). Many of these populations have achieved densities that are high enough to negatively impact the native food web (Irons et al. 2007, Freedman et al. 2012) and disrupt human connections to these natural resources (i.e., fishing, boating, and navigation). With prevention and early response no longer an option for most of the lower Ohio River Basin (ORB), it has been determined that large-scale removal projects may be one of the few tools that managers can still utilize to slow down the population's upstream expansion.

Agencies have implemented a suite of removal projects, supporting both incentivized commercial fishing, incentivized waterside pick-up, and contract fishing in various areas of the lower Ohio River basin and tributaries. When consistent removal efforts are conducted in areas where the established population meets the invasion front, it has a high potential to decrease upstream immigration, lower pressure on existing barriers, and reduce carp densities at locations where there are species of conservation concern or valued sport fisheries. Cannelton Pool currently marks the establishment front for Silver Carp populations within the mainstem Ohio River. In addition, there are several locations above Cannelton Locks and Dam where Grass and bigheaded carps can be consistently targeted with sampling gear that is essential to large-scale removal efforts. The purpose of this project is to utilize basin-wide knowledge in the ongoing efforts to control and contain invasive carp populations that have been established within the ORB. Additionally, the data collected during the targeted removal are used to augment the ongoing evaluation efforts that KDFWR conducts to determine the status of invasive carp populations in other pools of the Ohio River. Further down river, incentivized commercial harvest and processor pick-up provide tools to utilize existing infrastructure to suppress populations and reduce numbers where these fish are at peak abundance.

Objectives:

1. Target and remove invasive carp to suppress populations and reduce propagule pressure in the Ohio River basin.
2. Implement a removal program using contracted fishers at intensive management zones to reduce invasive carp numbers across the Ohio River basin.

Project Highlights:

1. A total of 111.4 hours of electrofishing effort was used to remove approximately 7,478 kg (~16,486 lbs) of invasive carp from three different pools of the Ohio River in 2024.
2. A total of ~2.57 million pounds (1.16M kg) of invasive carp have been harvested by contract fishing efforts conducted between July 2019 and February 2025.
3. Contract fishing efforts continued to remove high numbers of invasive carps from the Cannelton Pool of the Ohio River without negatively impacting native fish populations.
4. Incentivized commercial harvest resulted in the removal of 5,184,018 pounds of invasive carp in 2024.
5. Contract facilitation reimbursements to processors for waterside pickup supported the removal of 12,795,333 pounds of invasive carp in 2024.
6. WVDNR staff conducted three independent removal surveys in Tenmile Creek (Kanawha R.) and Raccoon Creek removing one Bighead Carp.
7. Agency crews also coordinated with USFWS-LGL FWCO on two removal events in Raccoon Creek and one in the disused lock chambers of the R.C. Byrd L & D complex. Three adult Bighead Carp and two adult Silver Carp were caught and removed from this effort.

Management agencies strongly believe that contract fishing downstream of McAlpine Locks & Dam and additional upstream removal efforts by agency staff should continue in order to reduce the densities of the mature invasive carp that are capable of successful reproduction.

Methods:

Clarification of Terminology Referenced in This Document

With the current rate of invasive carp expansion and the massive effort to study and adaptively manage carp impacts across a broad range of Mississippi River sub-basins, it is important to clarify terminology used in technical documentation and annual reports. Therefore, a list of terms and their respective definitions have been provided below.

Bigheaded Carps – Silver (*Hypophthalmichthys molitrix*), Bighead (*Hypophthalmichthys nobilis*), and their hybrids.

Establishment Front – The furthest upriver range of invasive carp populations that demonstrates natural recruitment.

Invasion Front – The furthest upriver extent where reproduction has been observed (eggs, embryos, or larvae), but recruitment to young-of-year (YOY) fish has not been observed.

invasive carp – One of four species (i.e. Silver Carp, Bighead Carp, diploid Grass Carp, and Black Carp) that originated from the continent of Asia.

Presence Front – The furthest upstream extent where invasive carp occur, but reproduction is not evident.

Targeted Removal of Invasive Carp

In 2024, KDFWR and INDNR combined for a total of over 110 hours of Invasive Carp removal efforts in the Cannelton, McAlpine and Markland pools of the Ohio River, which was nearly a 100% increase over the 57 hours completed in 2023. During these targeted removal efforts, agency crews utilized pulsed DC electrofishing via a MLES control box (40% duty-cycle) that was typically set at a rate of 80 pulses per second (pps). In previous years, KDFWR used gill nets near the downstream end of the sampling area to

target any Invasive Carp that tried to evade the electrofishing boat. However, a reduction in available field crews during most of 2024 required KDFWR to continue using an electrofishing-only approach to complete its targeted removal efforts.

The 2024 removal efforts continued to be conducted entirely within tributaries and embayments of the Markland, McAlpine and Cannelton pools. Upon capture, all bycatch species were immediately identified and released. All Invasive Carp were inspected for tags, and if present, the id numbers were used to determine the status of the transmitter. A healthy tagged fish with an active transmitter presented the only conditions when an Invasive Carp would have been intentionally released back into the river. Hence, any recaptured fish that contained an expired transmitter was also removed for population control. Prior to being euthanized, the total length, sex, and presence/absence of a spawning patch were recorded for each fish. Invasive Carp collected and removed during the first half of the year were not weighed in the field. Thus, weights for these fish were ultimately derived from pool-specific length-weight regressions that had to be compiled from historical data. However, KDFWR staff did record weights from Invasive Carp that were collected and removed during the fall (Sept – Dec), which was also required to complete relative weight calculations for the Early Detection and Evaluation Project (ED&D).

KDFWR continued to utilize the 2024 removal efforts to collect aging structures from invasive carp that were captured from the Cannelton, McAlpine and Markland pools. During such efforts, agency field staff identified Silver Carp from specific size classes and harvested otoliths to be processed and examined for the ongoing length-at-age analyses that was also being conducted for the Early Detection and Evaluation Project.

WVDNR staff conducted three independent removal surveys in Tenmile Creek (Kanawha R.) and Raccoon Creek during the reporting period (1,350ft. of net deployed). Gill nets (150ft, 5” mesh, 14ft-10ft) were set on opposite shores of the creek and allowed to soak for 2 hours or overnight. Agency crews also coordinated with USFWS-LGL FWCO on two removal events in Raccoon Creek and one in the disused lock chambers of the R.C. Byrd L & D complex. Seven nets were fished at Raccoon Creek during both events. Two nets were fished in each disused lock chamber overnight and were pulled the next morning.

Invasive Carp Contract Fishing Program

The KDFWR contract fishing program is constantly evolving and has undergone a number of minor changes since it officially began in July 2019. Some of these include the time of year that fishing occurred, the number of program participants out on the river each week and the amount of access that contract fishers had to waters outside of Kentucky (i.e. Indiana tributaries). All of these changes appeared to have some influence over the number of Invasive Carp being harvested from the Ohio River Basin. In 2024, KDFWR maintained contracts with six fishers that allowed them to target invasive carp in the mainstem river, tributaries and embayments of the Newburgh, Cannelton and McAlpine pools.

KDFWR also provided observers to accompany each program participant to record details about their fishing efforts (i.e., location, gear, etc) and the subsequent harvest of invasive carp. Throughout 2024, KDFWR observers continued to obtain total length (mm) and sex data from daily subsamples ($n = 20$) of each species of Invasive Carp (Silver, Bighead and Grass carp). During fall 2024, observers also began recording the weights (kg) of carp that had been selected for each subsample. Prior to these efforts, the weights of subsampled fish had been estimated using a predictive regression equation (pool-specific) that KDFWR biologists compiled from historical length-weight data for each species of Invasive Carp. And finally, KDFWR observers were responsible for identifying all bycatch that had been captured by the contract fishing gear to document the morbidity of non-target species.

In early 2024, there were administrative delays in the renewal of an exemption that allowed commercial fishing gear to be used within the borders of Indiana. This issue prevented program participants from being able to access Indiana tributaries and it essentially reduced the available contract fishing areas by more than 50%. By fall 2024, the contract fishers' access to all Indiana tributaries had been restored, but the program's schedule was adjusted once again to postpone contract fishing until mid-November. This decision was based on previous years of data that showed lower catch rates of Invasive Carp from October to December (i.e. 0 to only a few fish per day). The 2024 data ultimately supported this decision as lower numbers of carp were harvested prior to January 2025.

The Indiana Invasive Carp Harvest Permit Interim Rule was enacted in August 2024 authorizing the use of gill and seine nets for invasive carp harvest. The new permit enables KDFWR contract fishers to harvest invasive carp in Indiana waters and utilizes a new Indiana incentivized carp harvest program which launched around the same time. This new incentivized program was a pilot to evaluate if higher incentives would help increase harvest from the Wabash River basin. It paid fishers \$0.12 per pound and processors \$0.15 per pound to compensate for the lower condition of fish in that system.

Enhanced Contract Removal

Enhanced Contract Fishing was initiated in early 2022, offering contracts to licensed commercial fishers for compensation of \$0.10 per pound for invasive carp removed from designated commercial waters and sold to a fish processor(s) or other buyer(s) for at least \$0.07 per pound. The program used the same terms and maintains the designated waters of the previous program initiated in 2022. Designated waters includes the commercial waters of the following:

- (1) the portion of the Wabash River from the Ohio River to the southernmost city limits of Lafayette, Indiana
- (2) Skillet Fork River
- (3) Little Wabash River
- (4) Embarras River, except from Route 130 in Coles County upstream to the Harrison Street Bridge
- (5) Lake Charleston
- (6) Ohio River from McAlpine Dam to its confluence with the Mississippi River
- (7) the tailwaters of Kentucky and Barkley Lakes
- (8) Green River from the highway 259 bridge at Brownsville, Kentucky, downstream to the confluence with the Ohio River.

Contracted Facilitation

The Contracted Facilitation program also was initiated in early 2022 and offered contracts to fish processors and other buyers purchasing invasive carp from commercial fishers. Purchases must be made from either a facility or pick locations within 10 miles of designated waters. Compensation is \$0.05 per pound for invasive carp removed from designated commercial waters and purchased for at least \$0.07 per pound. This program facilitates practicable mechanisms for use of the harvested fish by private industry for a variety of purposes, including human consumption. The program in this proposal maintains similar terms and made the following changes to the designated waters. The designated waters from which fishers may remove invasive carp and where processors may pick up were expanded. New water bodies included LaGrange Pool on the Illinois River; Designated Waters – Designated waters include the commercial waters of the following:

- (1) Peoria and LaGrange Pools of the Illinois River
- (2) the portion of the Wabash River from the Ohio River to the southernmost city limits of Lafayette, Indiana
- (3) Ohio River from McAlpine Dam to its confluence with the Mississippi River
- (4) the tailwaters of Kentucky and Barkley Lakes
- (5) Kentucky and Barkley Lakes in Kentucky

(6) Green River from the highway 259 bridge at Brownsville, Kentucky, downstream to the confluence with the Ohio River.

Additional Fishing Areas - Invasive carp caught in the following waters may also be picked up at one of the above designated water pick up locations: (1) Little Wabash River; (2) Skillet Fork River; (3) Embarras River, except from Route 130 in Coles County upstream to the Harrison Street Bridge; and (4) Lake Charleston.

During 2024, KDFWR also decided to conduct an exploratory analysis of both the agency removal data and the contract fishing results. The intent was to answer the question of whether these management tools were biased in their size selectivity and were there any lines of evidence that need further analysis (i.e., refer to the Early Detection and Evaluation Project). Silver Carp length data from each removal effort was compared and there appears to be no observable difference between the length frequency of contract fishing and that of KDFWR's agency removal efforts.

Results:

Targeted Removal of Invasive Carp

Approximately 111.4 hours of boat electrofishing was conducted at a variety of tributary and mainstem sites located in three different pools (Cannelton, McAlpine and Markland) of the Ohio River. (Table 1). In 2024, KDFWR (with assistance from INDNR) used the combined efforts from all three pools to capture and removed a total 1,144 Invasive Carp, weighing an estimated 7,475 kg (16,480 lbs.). Like in previous years, most of the 2024 electrofishing efforts (56.3%) were conducted at sites in the McAlpine Pool, which resulted in the removal of 681 Invasive Carp weighing an estimated total of 4,723 kg (~10,412 lbs.). Bycatch of non-target species continue to be rarely encountered due to the highly selective nature of the electrofishing efforts. However, shad and alewife species were intentionally captured on occasion to verify that they were not juvenile (age-0 to age-1) Invasive Carp.

WVDNR staff conducted three independent removal surveys in Tenmile Creek (Kanawha R.) and Raccoon Creek during the reporting period. One Bighead Carp was removed. Agency crews also coordinated with USFWS-LGL FWCO on two removal events in Raccoon Creek and one in the disused lock chambers of the R.C. Byrd L & D complex. Three adult Bighead Carp and two adult Silver Carp were caught and removed from this effort.

Contract Fishing Program

At the beginning of 2024, KDFWR had enough observers on staff to regularly schedule up to 4 fishers a week. Program participants conducted an average of 57 fishing days per month during the first few months of 2024 (Jan – Mar) and ended this 3-month period with a total of 172 fishing days, which was comparable to the 168 days fished during this same time in 2023 (Table 2). During these efforts in Jan – Mar 2024, contract fishers used 583 gill net sets (~ 278,000 net ft) to harvest a total of 24,747 carp that had an estimated weight of more than 112,400 kg (~248,000 lb.). Contract fishing efforts in Jan-Mar 2024 yielded substantially fewer numbers of harvested Invasive Carp when compared to same time span in 2023. However, it was not unexpected given the reduction in available fishing areas and the fact that the 54,700 carp harvested in Jan-Mar 2023 was the program's highest harvest total for any 3-month period. After an average start to 2024, contract fishers continued to harvest similar numbers of Invasive Carp in April – June (n = ~15,600 fish). By the time that contract fishing efforts were suspended for the summer months, a total of nearly 40,380 invasive carp weighing an estimated 179,401 kg (~395,512 lb.) had been harvested during the first 5+ months of 2024.

Throughout 2024, program participants set an overall total of 1217 gill nets within both the Cannelton and Newburgh pools. In fact, the reduced access to Indiana tributaries during the first half of 2024 meant that sites within the Newburgh Pool had to be more regularly targeted by program participants. This trend started to decline some during the last couple months of 2024 after Indiana tributaries were once again opened to the contract fishing efforts.

During each year from 2019 to 2024, contract fishers have harvested three different species of Invasive Carp, which include Silver, Bighead and Grass carps. The most common by far, in terms of both numbers and weight, have been Silver Carp. In 2024, Silver Carp ($n = 46,346$) represented more than 98.8% of the harvested fish, while both Bighead ($n = 114$) and Grass ($n = 404$) carps combined to make up the other ~1.2% (Table 3). The species composition of all invasive carp caught in 2024 continued to echo an overall trend in the program's results where Silver Carp make up 98.3% of all carp ($n = 228,574$) caught by contract fishers in the last 6+ years (Jul 2019 – Feb 2025).

After comparing the mean daily catch of Invasive Carp during peak months (Oct-Mar) of the last six fishing seasons (2019-2024), there continues to be evidence that the most productive period for contract fishing includes the first few months of each year (Figure 1). Fishing effort during this six-month season initially increased from around 130 total fishing days in the 2020-2021 season to 253 days during this same period in 2021-2022. Since then, the efforts conducted during this "peak" season has remained relatively stable with 252 and 286 fishing days completed during the 2022-2023 and 2023-2024 seasons, respectively. However, during this reporting period, KDFWR's decision to delay the start of contract fishing to November 2024 will likely drop the effort down to just over 200 total fishing days for the current season (Oct 2024-Mar 2025). A combination of factors, including favorable river conditions, continuous access to all fishing areas and a full staffing complement, allowed program participants to harvest Invasive Carp at a very high rate (200-350 fish/day) over the last three months of the 2022-2023 fishing season. Since then, the contract fishing program encountered some issues (i.e. low water levels, access restrictions), but fishers did manage to harvest Invasive Carp at favorable rates for ~100 fish/day. In fact, with some exceptions (i.e. Jan 2025), contract fishers have maintained average harvest rates of 100-150 carp/day during most months of the current reporting period (Jan 2024 - Feb 2025).

In 2024, the monthly comparisons of mean daily harvest indicated that contract fishers had their highest catch rates of Invasive Carp during the months of May (175 carp/day) and January (158 carp/day) (Figure 2). Like in previous years, the 2024 catch rates appear to increase when river levels rise and water temperatures drop. However, if river levels rise too high (i.e. April 2024), a reduction in useable access points can cause a general decline in the contract fishers' productivity, which is usually indicated by lower daily harvest rates. And finally, standard errors in the daily harvest results continue to stand out during those months (i.e. Nov - Dec 2024) when contract fishers experience the highest amount of variability in their catch rates.

Gill nets continued to be the primary gear used during the seven-month period that program participants were actively fishing in 2024. Netting effort does vary and can often depend on the current catch rates, but throughout 2024, contract fishers typically set out 600-700 meters (2000-2300 ft) of webbing per day. The Silver Carp catch ranged in total length from 450 mm to 1000 mm with most of the fish (98.5%) measuring between 650 – 900 mm (Figure 3). Bighead and Grass carp were caught less frequently, but when harvested, most Bighead Carp (~89%) had total lengths of 800 to 1200 mm and nearly 92% of all Grass Carp measured between 800 - 1100 mm.

The bycatch from contract fishing efforts in 2024 was highest in January (24%) and December (28%) with other months showing that non-target species contributed between 9% and 21% of the total catch (Figure 4). All bycatch species were released immediately, and KDFWR observers specifically

documented any non-target fish that were either dead-on-arrival (DOA) or appeared to be moribund. Ictiobid species (i.e. Smallmouth, Bigmouth and Black buffalo) were the most common bycatch and contributed nearly 70% of all non-target fish (n = 6,585) (Table 4). Freshwater Drum (*Aplodinotus grunniens*), Catfish (*Ictaluridae* species) and Paddlefish (*Polyodon spathula*) were the next three most common types of bycatch captured in contract fishing nets. Even with the highest bycatch rates, the combined morbidity of the three Ictiobid species continued to be quite low at just over 3.7%. In fact, the only bycatch species in 2024 that exhibited a morbidity rate of 10% or more was the Logperch (~53%). However, despite its obvious sensitivity to the gear, very few Logperch were caught during this reporting period (n = 17) and it contributed to only 0.2% of the overall bycatch. KDFWR observers also continued to closely monitor the status of the Paddlefish (*Polyodon* spp), which is an important bycatch species that appears to be highly vulnerable to the contract fishing gear. Even though Paddlefish were the fourth most commonly caught bycatch (4.8%) in 2024, their morbidity rates were determined to be quite low (2.4%), especially when compared to the Ictiobids (3.7%), Longnose Gar (6.5%) and Freshwater Drum (6.8%).

To further understand the population structure of Silver Carp in Cannelton Pool, length frequency distributions from all agency removal data were overlaid with distributions generated from contract fishing subsample data from 2019 through 2024 (Figure 5). Distributions depict similar trends in length frequencies year to year, supporting that both forms of removal are effectively targeting the Silver Carp population in Cannelton Pool. Majority of fish captured, regardless of removal method, fall within the 600mm – 900mm size range.

The Indiana Invasive Carp Harvest Permit Interim Rule was enacted in August 2024 authorizing the use of gill and seine nets for invasive carp harvest. The initial phase was hampered by unfavorable fishing conditions, resulting in a total harvest of 101,988 pounds from August through December. KDFWR contract fishers contributed 38,667 pounds to this total from October through December, which is included in KDFWR's harvest data summarized below. The remaining 63,321 lbs. was harvested by fishers in the Wabash River who were enrolled in the incentivized program.

Enhanced Contract Removal

During 2024, ILDNR Enhanced Contract Removal Program had a total of 31 fishers under contract. With those 23 fishers, a total of 5,184,018 lbs of invasive carp were removed. Since the program's inception of March 2022, a total of 10,593,489 lbs have been removed from the designated waters of the Ohio River and its tributaries. Of that total amount, 98% of the invasive carp removed were Silver carp. February through July, and September and October were the months with the highest catch totals for 2024. Winter months (November, December) of 2024 saw a dramatic decrease in the amount of invasive carp reported harvest (Figure 6). The bulk of the harvest in 2024 occurred in the main-stem Ohio River and the Tailwaters of Kentucky and Barkley Lakes. (Table 5)

Contracted Facilitation

The Contracted Facilitation Program had 7 processors under contract in 2024. Throughout 2024 a total of 12,795,333 lbs. were processed. Since the Program's inception of March 2022, a total of 37,272,149 lbs. have been processed. Silver carp make up 91% of the total number of invasive carp processed, with Bighead, Grass and undisclosed invasive carp combining to make the remaining 9%. Contracted facilitation had its highest months in March and October. (Figure 6.)

Discussion:

The USACE locks and dam projects throughout the Ohio River are thought to provide some level of containment for the invasive carp species found within the mainstem river. Data acquired from several years of monitoring have demonstrated that average size and condition of Silver Carp increase as you move upstream, which is often accompanied by a transition to populations that consist of fewer, older fish. With it being a location where <400 mm carp are encountered each year, Cannelton continues to be one of the most upstream pools within the establishment zone. Because of this, its size and regular evidence of successful reproduction, the Cannelton Pool is considered to be a high-priority location for any future efforts to control the invasive carp population.

In 2024, KDFWR contracted with six program participants to provide the necessary fishing effort and hired as many as four observers to record harvest success and any impacts of non-target species. Overall, fishers continued to be most successful when their efforts are focused within tributaries, where decreased water depths allow the gill nets to catch Invasive Carp at higher rates. Because of past difficulties in capturing carp during warmer months, all fishing efforts were postponed from June through October of 2024, which is also expected to have helped reduce impacts on bycatch species. Any effect this has on the morbidity rates of bycatch continues to be examined closely, especially as more data is collected during upcoming years. Unlike when the fishing resumed in early October 2023, the restart of the program in 2024 was intentionally delayed until mid-November to concentrate the contract fishing efforts to the most productive months of the year. Once efforts resumed on November 13, 2024, the program participants immediately began employing the same group fishing techniques that produced higher harvest rates in recent years. These techniques are considered to be an optimization of the program's fishing efforts as they require all participants to concentrate their nets in the same tributary.

Agency crews continue to provide regular recommendations based off previous years' experience and monitoring efforts. This includes information on where to target Invasive Carp and what gear specifications could be used to maximize fishing success; however, contract fishers have been routinely allowed to utilize gears that they felt would work best during each fishing event. Participants continued to use gill nets with webbing constructed of 3.25 to 4.5 in bar-mesh throughout 2024, which appeared to provide the best results when Silver Carp was the primary target. Earlier in the program, contract fishers started setting nets in specific locations with the purpose of closing off any routes that invasive carp could use to leave a tributary if/when they were able to avoid the initial capture efforts. This practice was intended to allow the contract fishers to repeatedly target an area until all invasive carp had been captured and removed. However, this would only produce the expected result if/when the appropriate amount of fishing pressure was applied directly upstream of these "block nets". This was a primary factor in KDFWR's decision to instruct multiple contract fishers to focus their efforts in the same tributary and/or embayment. These "group fishing" techniques were initially implemented during the second half of 2021 and appeared to result in immediate improvements. Higher harvest totals in 2022 through 2024 strongly support the continued use of group fishing, especially in areas with higher densities of invasive carp (i.e. Cannelton & Newburgh pools).

Similar to previous years, agency observers in 2024 continued to report that most bycatch was healthy at the time of release. After having the highest morbidity rates in 2023, the Paddlefish captured and released by contract fishers in 2024 fared quite better, as there were as many as seven bycatch species with higher morbidity during this reporting period (Table 4). Ictiobids (i.e. Smallmouth Buffalo) were once again by far the most common bycatch in 2024, which was followed by Freshwater Drum and Catfish. Like in previous years, the overall morbidity rate of ~4.0% in 2024 means that most bycatch appeared to be unharmed, or only minimally injured, following their release. In addition to the shift to cooler water

temperatures, the instances of low bycatch mortality were likely aided by the continued practice of rapidly setting and pulling the gill nets.

For agency removal efforts, electrofishing methods used in 2024 continued to produce the most success for the crews that were targeting lower density populations of invasive carp. When available, these efforts can be even more effective if side-scan technology is used to locate schools of Silver Carp that can be herded into gill nets using the electrofishing gear. However, capture success appears to be highly dependent on the experience of both the driver and the dipper. Targeting tributary waters gives removal crews an advantage because current sampling gears are often more effective in shallower water and the tributary banks help keep the invasive carp from scattering too far away from the electrofishing boats.

In areas where invasive carp population densities are high, incentivizing removal by contract fishers is an economical strategy to reduce biomass, lessening impacts on native fisheries and reducing propagule pressure upstream. Incentivized commercial harvest has steadily increased from 1.4 M pounds in 2022 to over 5 M pounds in 2024. The bulk of this harvest consist of Silver Carp. Most of the harvest occurred within the Kentucky and Barkley Lake tailwaters (2.4M) with another 2.3M pounds harvested from the Ohio River.

The enhanced facilitation program provides a unique opportunity to facilitate commercial fishing efforts by incentivizing processors to pick up the fish near where the fishing occurs rather than requiring commercial fisher to haul fish hundreds of miles. The program incentivized removal of over 12 M pounds of invasive carp in 2024. Most of the incentivized removal occurred in Barkley Lake (4.1 M and the Illinois River (4.1 M). The Kentucky and Barkley Lake tailwaters followed 1.8 M) with another 1.6 M coming from the Ohio River.

This program facilitates practicable mechanisms for use of the harvested fish by private industry for a variety of purposes, including human consumption. This program also contributes to providing critical information on population densities of invasive carp over time in the Ohio River system to guide agency management efforts.

Recommendations:

It is imperative that fishing pressure is sustained and/or increased throughout Cannelton Pool to help protect and reduce migration of invasive carps further up the Ohio River. Contract fishing should continue to support population control efforts and should be closely monitored so that recommendations can be made to increase efficiency and successful harvest. Agency crews should continue to conduct removal efforts in lower density pools and internal waters to help reduce the numbers of all invasive carp species. Outreach and efforts to spur public and commercial interest within the ORB should continue as it is likely to become even more important to the long-term control of the current invasive carp populations. Further work in aiding facilitation of harvests to markets should continue in the future as it is expected to become even more difficult to convince commercial anglers to become long-term participants of the ongoing contract fishing program. Finally, KDFWR believes it is important to continue to measure a subsample of the harvested Invasive Carp removed by contract fishers. These data may be used to evaluate the length and weight of captured individuals and compare these data between removal and harvest gear types and locations.

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Table 1. Results of electrofishing efforts that KDFWR and INDNR conducted in 2024 with the primary objective of removing Invasive Carp from the middle Ohio River.

OHR Pool	Agency	Effort (hr.)	Total Count (N)				Total Weight (kg)			
			Bighead Carp	Silver Carp	Grass Carp	Total	Bighead Carp	Silver Carp	Grass Carp	Total
Cannelton	KDFWR	3.2	0	127	1	128	0	587.6	7.2	594.8
	INDNR	16.3	0	264	0	264	0	1409.6	0	1409.6
McAlpine	KDFWR	62.7	2	677	2	681	11.9	4700.3	11.2	4723.4
Markland	KDFWR	22.9	6	52	1	59	17.2	563.1	11.4	591.7
	INDNR	6.3	0	12	0	12	0	158.1	0	158.1
Combined	All	111.4	8	1132	4	1144	29.1	7418.7	29.8	7477.6

Table 2. Summary of results obtained by contract fishers between 2019 to February 2025. A “fishing day” equals 1 crew fishing ~8 hr.

Year	Months	Fishing Effort			Total Carp Harvested	# Carp per Day	Total Harvest (kg)	Total Harvest (lb)	Mean Length & Weight			
		Days	Nets	Net Feet					TL mm	TW kg	TL in	TW lb
2019	Jul-Sep	26	191	87,615	2,640	101.5	15,261.6	33,646.0	843	5.78	33.2	12.74
	Oct-Dec	65	640	289,790	4,209	64.8	24,982.6	55,077.1	847	5.93	33.4	13.07
	Total	91	831	377,405	6,849	75.3	40,244.1	88,723.1	846	5.87	33.3	12.94
2020	Jan-Mar	52	352	198,366	7,433	142.9	44,042.5	97,097.1	834	5.93	32.8	13.07
	Apr-Jun	37	345	161,120	3,247	87.8	15,991.4	35,254.9	795	4.92	31.3	10.85
	Jul-Sep	28	318	118,775	1,371	49.0	6,375.2	14,055.0	772	4.65	30.4	10.25
	Oct-Dec	67	528	307,850	3,765	56.2	23,247.6	51,252.2	830	6.17	32.7	13.60
	Total	184	1543	786,111	15,816	86.0	89,656.7	197,659.3	813	5.67	32.0	12.50
2021	Jan-Mar	67	474	251,400	8,429	125.8	51,142.9	112,750.7	842	6.07	33.1	13.38
	Apr-Jun	40	243	189,520	3,115	77.9	15,855.3	34,955.0	814	5.09	32.1	11.22
	Jul-Sep	2	14	6,000	66	33.0	321.7	709.1	742	4.87	29.2	10.74
	Oct-Dec	97	562	289,875	8,060	83.1	39,882.4	87,925.7	786	4.95	31.0	10.91
	Total	206	1293	736,795	19,670	95.5	107,202.2	236,340.4	813	5.45	32.0	12.02
2022*	Jan-Mar	156	744	369,150	21,993	141.0	116,790.4	257,478.9	822	5.31	32.4	11.71
	Apr-Jun	22	101	53,350	4,976	226.2	25,066.1	55,261.2	837	5.04	32.9	11.11
	Oct-Dec	84	433	235,360	13,431	159.9	68,093.3	150,119.9	805	5.07	31.7	11.18
	Total	262	1278	657,860	40,400	154.2	209,949.8	462,860.0	818	5.20	32.2	11.46
2023*	Jan-Mar	168	711	325,100	54,700	325.6	276,210.1	608,939.1	832	5.05	32.8	11.13
	Apr-Jun	112	403	183,200	19,294	172.3	96,465.0	212,668.9	809	5.00	31.8	11.02
	Oct-Dec	114	429	287,213	8,196	71.9	35,957.6	79,273.0	774	4.39	30.5	9.68
	Total	394	1543	795,513	82,190	208.6	408,632.7	900,881.0	813	4.97	32.0	10.96
2024*	Jan-Mar	172	583	278,000	24,747	143.9	112,417.6	247,832.0	784	4.54	30.9	10.01
	Apr-Jun	124	417	201,130	15,634	126.1	66,983.4	147,674.7	782	4.28	30.8	9.45
	Oct-Dec	79	217	103,300	6,483	82.1	31,059.5	68,472.5	780	4.79	30.7	10.56
	Total	375	1217	582,430	46,864	125.0	210,460.5	463,979.2	782	4.49	30.8	9.90
2025	Jan-Mar	134	364	169,400	16,785	125.3	98,417.2	216,974.2	806	5.86	31.7	12.93
	Total	134	364	169,400	16,785	125.3	98,417.2	216,974.2	806	5.86	31.7	12.93
ALL YEARS	Jan-Mar	749	3228	1,591,416	134,087	179.0	699,020.6	1,541,072.0	820	5.21	32.3	11.49
	Apr-Jun	335	1509	788,320	46,266	138.1	220,361.2	485,814.7	807	4.76	31.8	10.50
	Jul-Sep	56	523	212,390	4,077	72.8	21,958.5	48,410.1	803	5.39	31.6	11.88
	Oct-Dec	506	2809	1,513,388	44,144	87.2	223,223.0	492,120.4	804	5.06	31.7	11.15
	Total	1646	8069	4,105,514	228,574	138.9	1,164,563.4	2,567,417.3	808	5.09	31.8	11.23

* Contract fishing was not conducted during summer months (Jul-Sep).

Table 3. A breakdown of total counts and weights of Invasive Carp harvested by contract fishers from 2019 to Feb 2025. All data was recorded by KDFWR observers.

Cannelton Pool (2019 – early 2025)				
Year	Spp	Total IC Caught	Harvest Weight (kg)	Harvest Weight (lb)
2019	BHC	265	2,197.9	4,845.6
	GRC	129	1,264.4	2,787.6
	SVC	6,455	36,781.8	81,089.9
	ALL	6,849	40,244.0	88,723.1
2020	BHC	279	2,247.5	4,954.9
	GRC	235	1,975.7	4,355.7
	SVC	15,298	85,407.7	188,291.8
	ALL	15,812	89,630.9	197,602.3
2021	BHC	189	2,034.0	4,484.2
	GRC	208	1,564.5	3,449.2
	SVC	19,158	103,012.7	227,104.0
	ALL	19,555	106,611.2	235,037.4
2022	BHC	428	4,224.5	9,313.5
	GRC	298	2,234.7	4,926.7
	SVC	39,674	203,490.5	448,619.8
	ALL	40,400	209,949.8	462,860.0
2023	BHC	492	5,168.3	11,394.1
	GRC	507	4,020.3	8,863.2
	SVC	76,737	382,736.2	843,788.9
	ALL	77,736	391,924.7	864,046.1
2024	BHC	92	1,283.7	2,830.1
	GRC	155	1,498.2	3,303.0
	SVC	20,831	108,223.5	238,587.4
	ALL	21,078	111,005.4	244,720.4
2025	BHC	95	1,338.6	2,951.0
	GRC	146	1,427.2	3,146.4
	SVC	14,770	83,148.5	183,314.4
	ALL	15,011	85,914.3	189,411.7
All	BHC	1,840	18,494.5	40,773.3
	GRC	1,678	13,985.0	30,831.7
	SVC	192,923	1,002,800.9	2,210,796.1
	ALL	196,441	1,035,280.4	2,282,401.2

Newburgh Pool (2023 - early 2025)				
Year	Spp	Total IC Caught	Harvest Weight (kg)	Harvest Weight (lb)
2023	BHC	4	46.4	102.0
	GRC	24	174.7	385.0
	SVC	4,426	16,486.9	36,347.4
	ALL	4,454	16,708.0	36,834.9
2024	BHC	22	302.7	667.4
	GRC	249	1,930.9	4,257.4
	SVC	25,515	97,221.5	214,334.1
	ALL	25,786	99,455.1	219,258.9
2025	BHC	1	13.7	30.2
	GRC	11	96.9	213.7
	SVC	320	1,301.6	2,869.7
	ALL	332	1,412.3	3,113.6
All	BHC	27	362.8	799.6
	GRC	284	2,202.5	4,856.1
	SVC	30,261	115,010.0	253,551.2
	ALL	30,572	117,575.4	259,206.9

McAlpine Pool (2020, 2021 & 2025)				
Year	Spp	Total IC Caught	Harvest Weight (kg)	Harvest Weight (lb)
2020	BHC	0	0.0	0.0
	GRC	2	16.6	37.0
	SVC	2	9.2	20.3
	ALL	4	25.8	57.0
2021	BHC	0	0.0	0.0
	GRC	6	65.2	144.0
	SVC	109	525.9	1,159.4
	ALL	115	591.1	1,303.0
2025	BHC	0	0.0	0.0
	GRC	0	0.0	0.0
	SVC	1,442	11,090.6	24,448.9
	ALL	1,442	11,090.6	24,448.9
All	BHC	0	0.0	0.0
	GRC	8	81.8	181.0
	SVC	1,553	11,625.7	25,628.6
	ALL	1,561	11,707.5	25,809.6

All Pools & Years Combined				
Years	Species	Total Catch	Harvest Weight (kg)	Harvest Weight (lb)
2019 - 2025	BHC	1,867	18,857.3	41,572.9
	GRC	1,970	16,269.3	35,868.8
	SVC	224,737	1,129,436.6	2,489,975.9
	ALL	228,574	1,164,563.3	2,567,417.7

Table 4. Detailed summary of the bycatch species recorded during contract fishing efforts in January - December 2024. Healthy, or resilient, fish are those that recovered quickly and swam away under their own power, while moribund fish suffered significant damage and could not swim off after being released.

Bycatch Fish Spp. (Common Name)	Genus/Species	Resilient Count	Moribund Count	% Morbidity	Total Count	% of All Bycatch
Bigmouth Buffalo	<i>Ictiobus cyprinellus</i>	305	5	1.6	310	3.3
Black Buffalo	<i>Ictiobus niger</i>	103	9	8.0	112	1.2
Blue Catfish	<i>Ictalurus furcatus</i>	307	2	0.6	309	3.3
Bluegill/Redear	<i>Lepomis</i> spp	2	0	0.0	2	< 0.1
Bowfin	<i>Amia calva</i>	1	0	0.0	1	< 0.1
Channel Catfish	<i>Ictalurus punctatus</i>	52	0	0.0	52	0.6
Common Carp	<i>Cyprinus carpio</i>	250	4	1.6	254	2.7
Crappie species	<i>Pomoxis</i> spp	10	0	0.0	10	0.1
Flathead Catfish	<i>Pylodictis olivaris</i>	66	0	0.0	66	0.7
Freshwater Drum	<i>Aplodinotus grunniens</i>	936	68	6.8	1004	10.6
Gizzard Shad	<i>Dorosoma cepedianum</i>	69	3	4.2	72	0.8
Largemouth Bass	<i>Micropterus salmoides</i>	2	0	0.0	2	< 0.1
Logperch	<i>Percina caprodes</i>	8	9	52.9	17	0.2
Longnose Gar	<i>Lepisosteus osseus</i>	229	16	6.5	245	2.6
Mooneye	<i>Hiodon tergisus</i>	1	0	0.0	1	< 0.1
Paddlefish	<i>Polyodon spathula</i>	445	11	2.4	456	4.8
Quillback	<i>Carpionodes cyprinus</i>	9	0	0.0	9	0.1
River Carpsucker	<i>Carpionodes carpio</i>	18	0	0.0	18	0.2
Sauger/Saugeye	<i>Sander</i> spp	14	0	0.0	14	0.2
Shortnose Gar	<i>Lepisosteus platostomus</i>	17	0	0.0	17	0.2
Skipjack Herring	<i>Alosa chrysochloris</i>	13	1	7.1	14	0.1
Smallmouth Bass	<i>Micropterus dolomieu</i>	13	0	0.0	13	0.1
Smallmouth Buffalo	<i>Ictiobus bubalus</i>	5931	232	3.8	6163	65.3
Spotted Gar	<i>Lepisosteus oculatus</i>	63	0	0.0	63	0.7
Striped Bass	<i>Morone saxatilis</i>	192	20	9.4	212	2.2

TOTALS BY LOCATION						
Month	Total Lbs.	Catch Location *				
		Ohio River	Wabash River	Tailwaters (KY and Barkley Lakes)	MS River	Kaskaskia
2022 Totals	1,425,591	114,594	1,310,997			
Jan-23	191,613	116,847	74,766			
Feb-23	272,169	232,172	39,997			
Mar-23	432,469	298,485	133,984			
Apr-23	394,544	224,874	163,807	5,863		
May-23	418,971	125,785	293,186			
Jun-23	312,485	304,774	7,711			
Jul-23	236,870	192,665		44,205		
Aug-23	260,035	83,198		176,837		
Sep-23	267,302	88,084	2,849	176,369		
Oct-23	436,799	139,728	36,890	260,181		
Nov-23	131,068	86,449	17,667	26,952		
Dec-23	180,018	155,785	23,120	1,113		
2023 Totals	3,534,342	2,048,845	793,977	691,520	0	0
Jan-24	349,222	231,269	117,953	0	0	
Feb-24	513,709	479,228	7,922	0	26,558	
Mar-24	588,277	571,063	10,279	0	6,935	
Apr-24	471,518	357,815	32,052	62,158	19,493	
May-24	519,997	314,359	42,363	118,576	44,699	
Jun-24	649,331	140,065	0	485,109	24,157	
Jul-24	550,236	29,502	0	516,823	3,911	
Aug-24	151,382	68,097	0	81,495	1,790	
Sep-24	461,775	29,219	0	432,556	0	
Oct-24	577,824	35,225	0	542,599	0	
Nov-24	204,039	34,620	0	167,233	0	2,186
Dec-24	146,708	96,394	0	50,314	0	0
2024 Totals	5,184,018	2,386,856	210,569	2,456,863	127,543	2,186

Table 5. Enhanced contract fishing harvest totals by river reach.

Figure 1. An illustration of the differences in mean Silver Carp harvest (total fish/day) for peak months over the past six fishing seasons. Error bars represent the standard error of the daily catch totals obtained from the contract fishers.

2024 Contract Fishing Results | Mean Harvest Rates (Carp/Day)

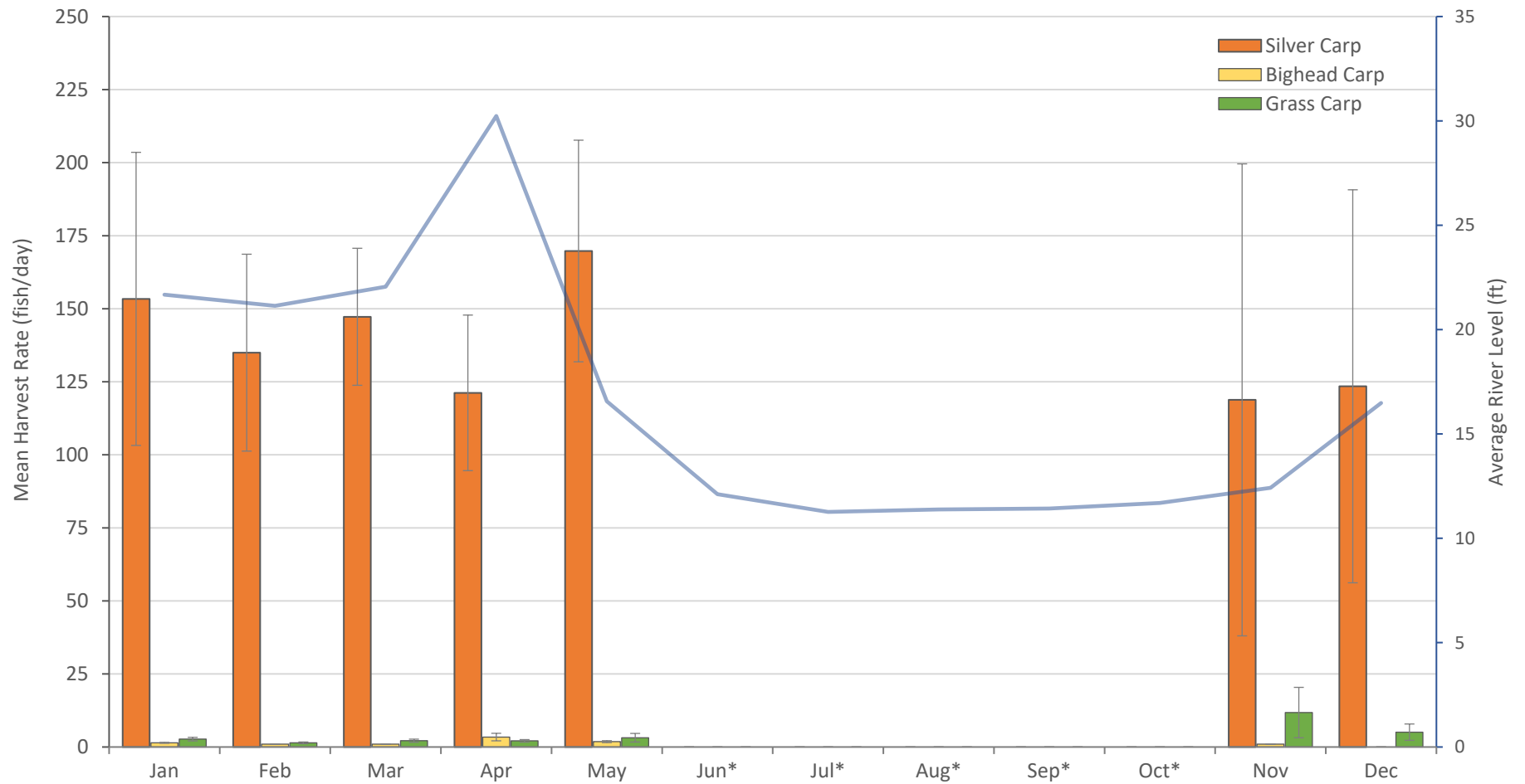


Figure 2. The average harvest rates (fish/day) in months between January and December 2024 that KDFWR employed contract fishermen to remove Invasive Carp. Error bars represented the standard error for daily catches. In addition, mean river level was calculated from data recorded by a USGS gage located at Cannelton Locks & Dam (blue line). Average daily landings in 2024 continued to be influenced by both temperature and river levels.

Silver Carp Length Frequency | Cannelton Pool 2020-2024

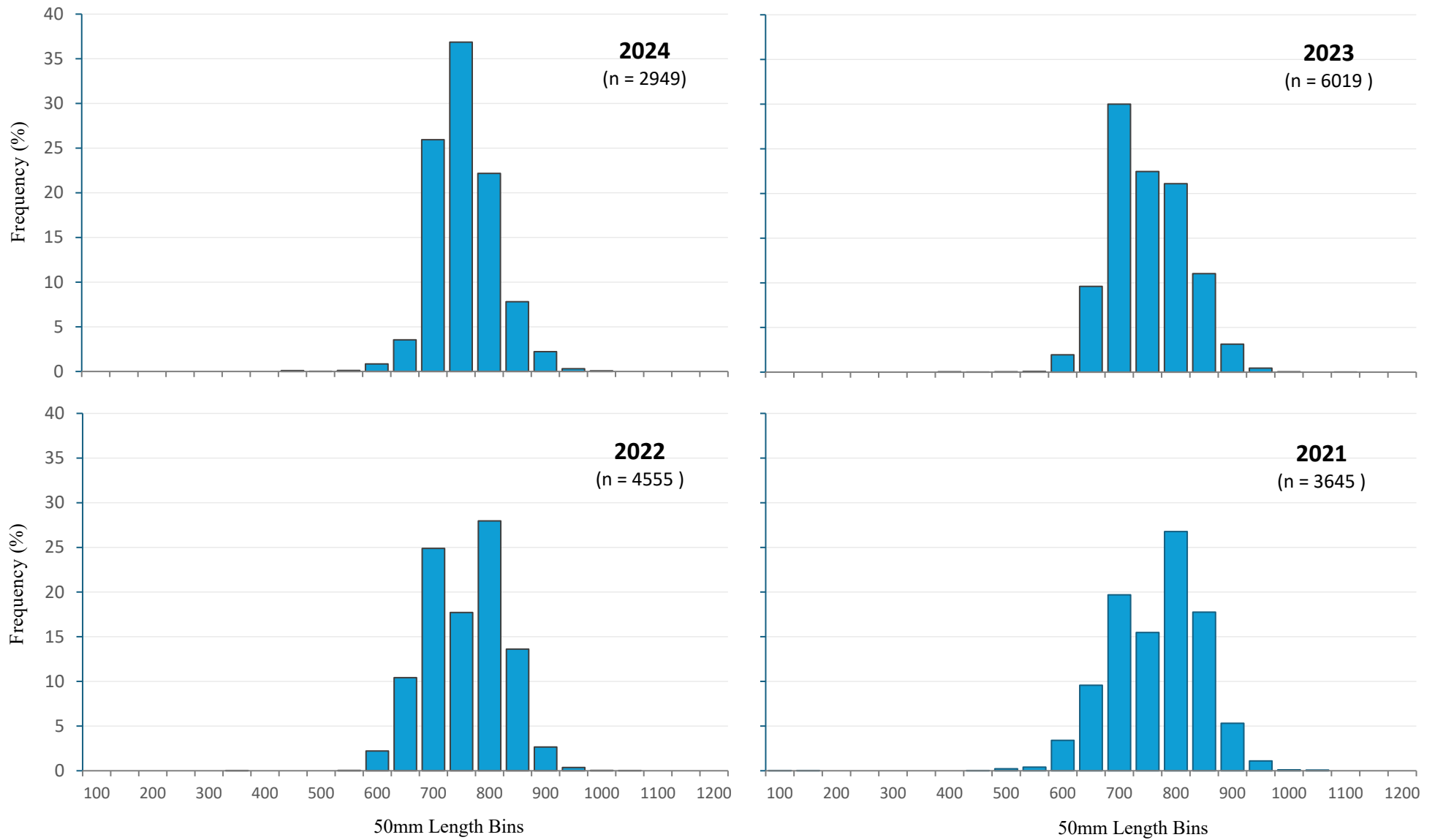


Figure 3. Length frequency distributions generated from subsamples of Silver Carp that contract fishers harvested from the Cannelton Pool in 2020-2024.

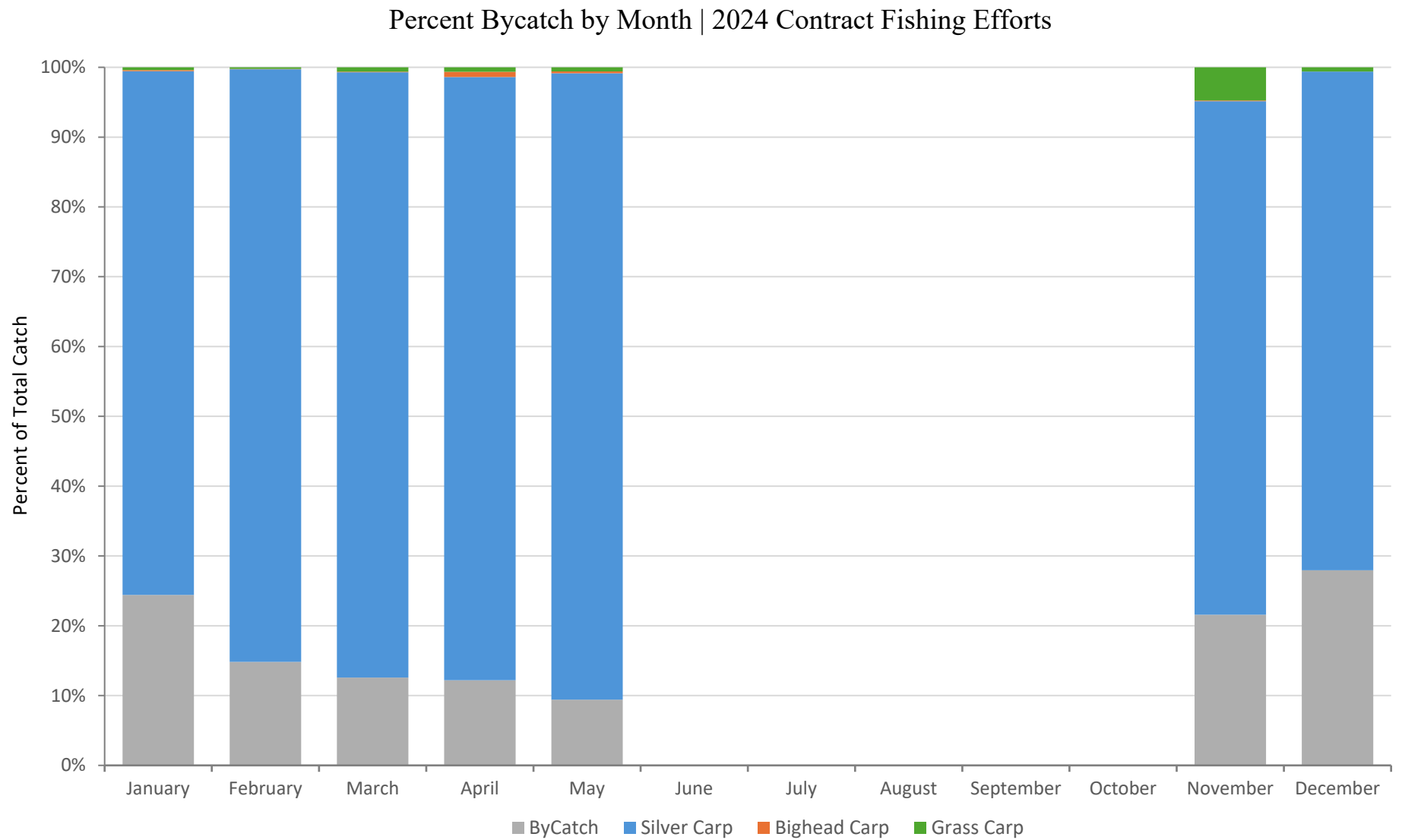


Figure 4. The monthly percent contribution of bycatch and three Invasive Carp species targeted by contract fishers from January to December 2024.

Silver Carp Length Frequency | Cannelton Pool (2019-2024)

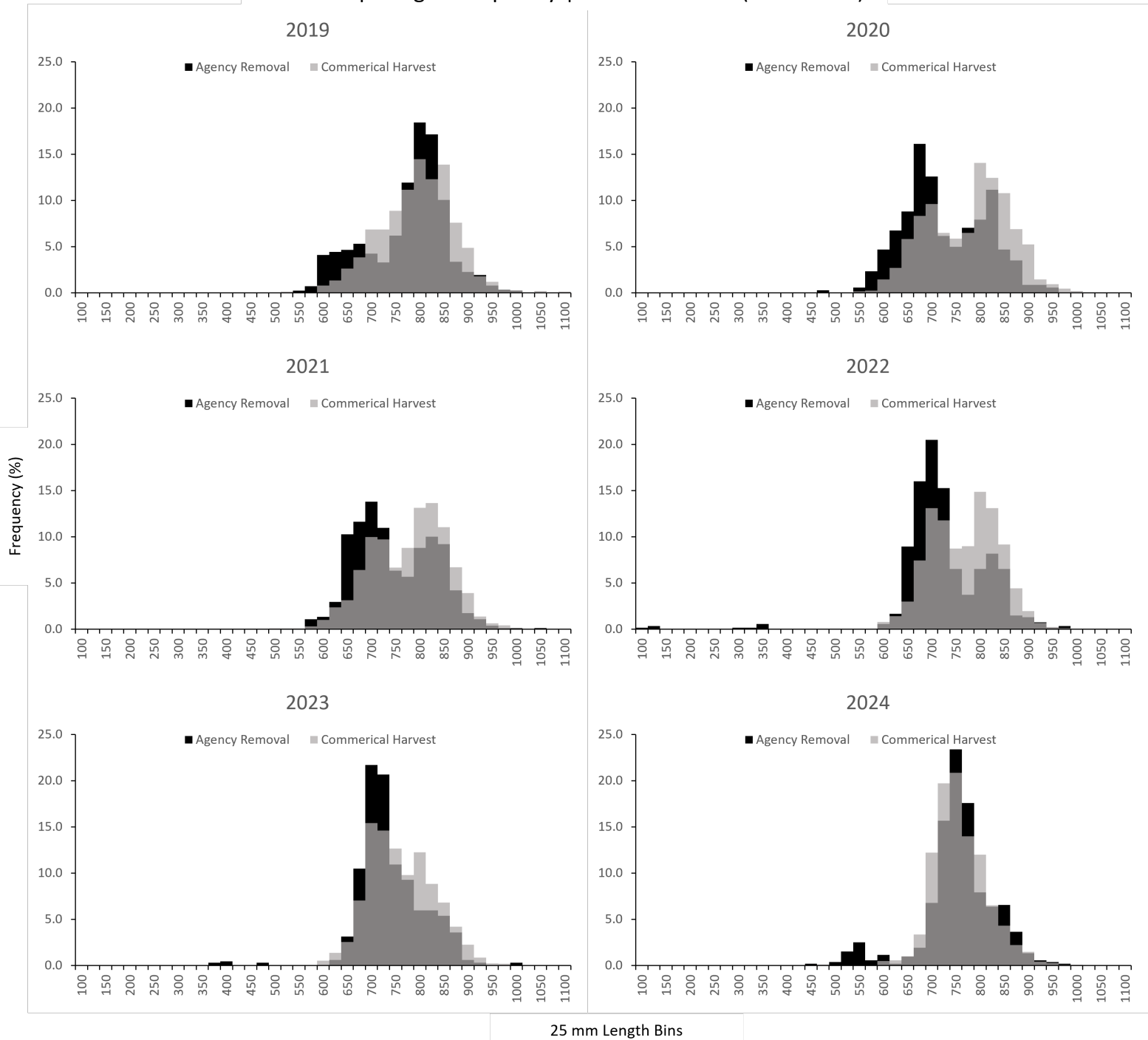


Figure 5. Length frequency distributions generated from agency removal data overlaid with length frequency distributions from contract fishing subsample data (2019-2024).

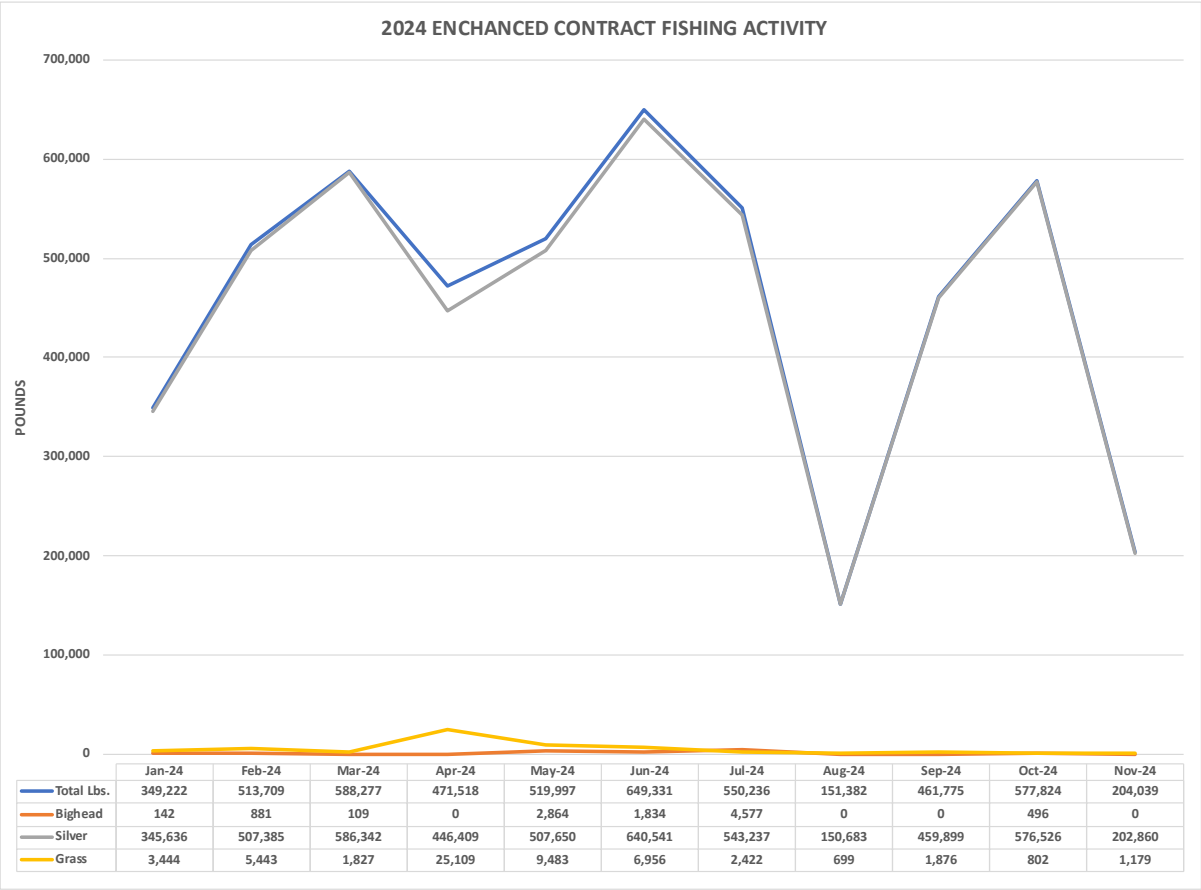


Figure 6. 2024 Enhanced Contract Removal per month.

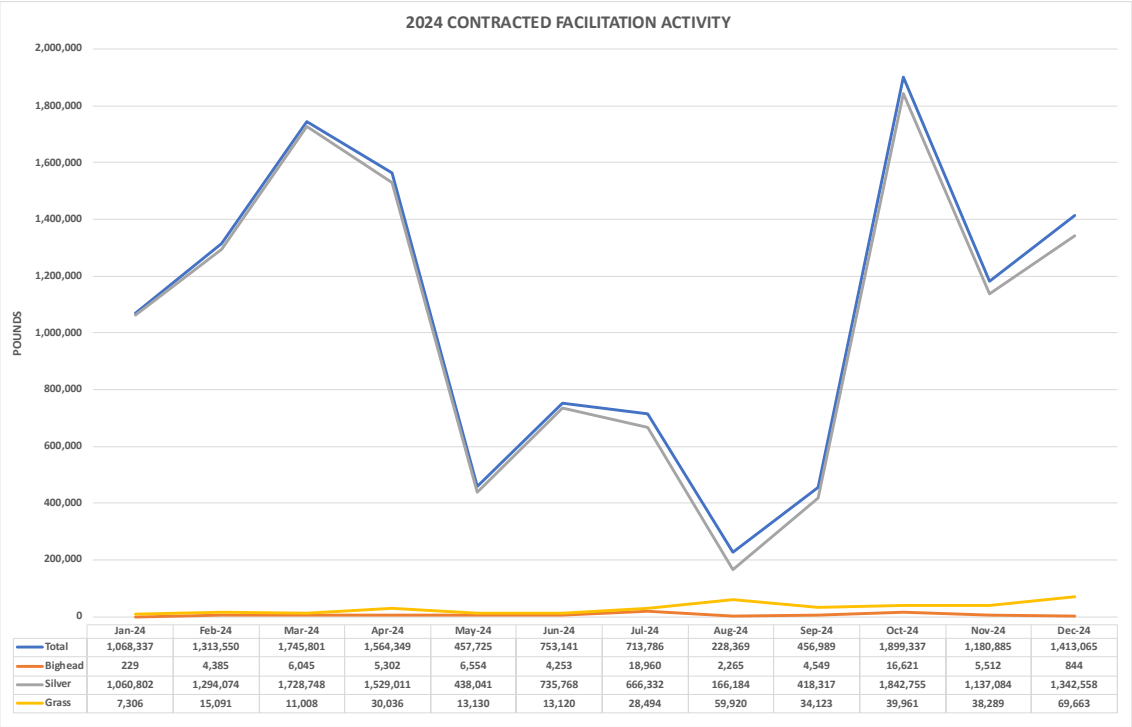


Figure 7. 2024 monthly processed totals for the Contracted Facilitation project.