**ILLINOIS CHAPTER AMERICAN FISHERIES SOCIETY**

# 2022 ILLINOIS REPORT

# TO THE

# NORTH CENTRAL DIVISION AFS

# RIVERS AND STREAMS TECHNICAL COMMITTEE

Respectfully submitted

March 30, 2022

**Rivers and Streams Presentations from the 2022 Joint Conference of the Illinois Chapter of the American Fisheries Society and the Illinois Lake Management Association**

**Cory Suski, University of Illinois**
**Development of a novel technology to deter the movements of invasive fishes – a new CO2-L?**
Invasive species are a hot button topic in fisheries, resource, conservation, stewardship, and public outreach arenas; and rightly so. One of the biggest questions is what can we do to prevent the spread? With regards to the invasive bigheaded carp species that continue to wreak havoc on our Midwest waters, our research group has taken our experience with physiological responses of fishes and used it to develop a novel technology to deter movements. We will discuss this project design, implementation, and some data. We will also discuss the most important part; what it means for our ecosystem now and moving forward in the future.

**Dahlia Martinez, Eastern Illinois University**
**Using Active Tracking to Assess Diurnal and Seasonal Habitat Use of Bigheaded Carp in the Wabash and White River**
*The prevalence of invasive species is an ever-growing issue in the Midwest. The objective of this study was to assess the seasonal and diurnal movement and habitat use of Silver Carp (Hypophthalmichthys molitrix) in the Wabash River and White River. We hypothesized there would be diurnal and seasonal differences between ranges of Silver Carp in the Wabash and White Rivers. We also predicted there would be selectivity for logjam habitats in Silver Carp as well as diurnal and seasonal variations in macro and micro-habitat use. Monthly macro & micro active tracks were conducted using acoustic telemetry throughout the study reaches. The location, habitat type, and habitat conditions of tagged fish were recorded. Analysis of variance tests were used to analyze trends in habitat selectivity by sex, season, and time of day. Eighty-three total detections were recorded for the summer, fall, and winter periods. Habitat use of Silver Carp did vary seasonally and diurnally as predicted. Most notably, Silver Carp were predominantly located in logjam microhabitats during the summer sampling and in the thalweg during fall sampling. Fish were also predominantly detected in outside bend habitats throughout both summer and fall.*

**Bryan Sea, University of Illinois Urbana-Champaign**
**Bigmouth Buffalo Movement and Habitat Overlap with Paddlefish and Bigheaded Carp**
*In the Upper Mississippi River (UMR), dams can impede the longitudinal movement of native fishes. Although passage is feasible at most UMR dams under the right conditions, pinch-point dams rarely experience open river conditions and often restrict all passage to the lock chamber, restricting access to upstream habitats. We tagged 180 bigmouth buffalo and 150 bigheaded carps with acoustic transmitters in pools 15-19 in the UMR to 1) determine the passage frequency and movements of bigmouth buffalo across UMR dams and 2) determine the habitat use and overlap between bigmouth buffalo, paddlefish, and bigheaded carps. Due to the low number of bigmouth buffalo passages at the pinch point dam, residency in the downstream approach will be analyzed to show how the fish are interacting around the dam and the environmental conditions associated with their presence or absence. Bigmouth buffalo linear home ranges ranged from 0.29-40.72 km with a mean of 7.72 km. Habitat overlap occurred between all three species and they all occupied side channels or channel borders, and this may result in competition where these species inhabit the same areas. We observed a low number of passages which is likely due to the low water levels in 2020.*

**Joseph Rector, Southern Illinois University**
**Status of Ohio River Crappie Population Vital Rates and Relationships Between Environmental Variables and Year-Class Strength**

*Though demographics and vital rates of black crappie and white crappie populations in lakes and reservoirs have historically been well researched, published information on crappie population dynamics in large river systems is deficient. Embayments at the confluences of tributaries and large rivers and their associated backwaters can serve as important low current, structure rich habitat for crappies, especially in systems like the Ohio River that lack extensive natural backwater areas due to a geologically constrained river valley and human modifications. As a result, crappie population densities are often much higher in tributary embayments than in the mainstem river. The objectives of this study were to estimate recruitment, growth, and mortality rates using aged otoliths and length/weight data for crappies sampled from the Ohio River and associated tributaries during 2020 and 2021. Patterns of year-class strength were identified using catch curve residuals and were used to model relationships between recruitment and environmental variables. Results of this study provide useful baseline information for management of black and white crappie populations in large river-tributary systems.*

**Sam Shaick, Illinois Natural History Survey**
**Catfish and Smallmouth Buffalo Populations in Commercially Versus Non-Commercially Harvested Pools of the Illinois River**
*Buffalo (Ictiobus spp.) and catfish (Ictalurid) are the two most commercially harvested groups of native fishes in the Illinois River. Further, Channel Catfish, Flathead Catfish, and Smallmouth Buffalo are the most abundant species of these groups. Within the Illinois River, commercial fishers are allowed unregulated buffalo harvest and unlimited harvest of catfishes over 15 inches. Aside from invasive carps, commercial harvest above Route 89 near Spring Valley, IL is prohibited due to increased contaminants in the Upper Illinois River. We investigated the potential effects that these different regulations may have on Channel Catfish, Flathead Catfish, and Smallmouth Buffalo relative abundance, size structure, and condition. Because the Route 89 bridge is within the Peoria Pool of the Illinois River, this pool was used as a buffer between the lower, commercially harvestable pools (Alton and La Grange) and the upper, non-commercially harvestable pools (Marseilles and Starved Rock). From June-October of 2019 and 2020, the aforementioned species were sampled using paired small and large hoop nets baited with soybean cake. Fishes were measured to the 10mm bin from June-September 15. From September 16-October 31, fishes were measured to the nearest millimeter and weighed to the nearest gram. Relative abundance was calculated using catch per unit effort (CPUE) as fish per hoop net set. Also, we used relative weight (Wr) to compare condition and proportional size distribution (PSD) to examine size structure.*

**Brian Valleskey, Geosyntec**
**What is a NARP**
*Illinois EPA had proposed a total phosphorus effluent standard of 1.0 milligrams per liter (mg/L) for major POTWs. Environmental non-governmental organizations (ENGOs) were concerned that this standard of 1 mg/L would not address phosphorus-related impairments or protect local waterways and instead proposed an effluent standard of 0.1 mg/L. The Illinois Association of Wastewater Agencies (IAWA) was concerned that the ENGOs' proposed 0.1 mg/L would impose significant financial burdens on ratepayers and would not necessarily achieve measurable water quality benefits due to site-specific conditions. This disagreement created a substantial permitting backlog in Illinois. Illinois EPA, IAWA, ENGOs negotiated the NARP requirement in 2018 to overcome the permitting backlog and make progress towards reducing phosphorus loads at POTWs.*

**Austin Omer, Illinois Farm Bureau**
**Illinois Farm Bureau's efforts toward implementing the Illinois Nutrient Loss Reduction Strategy**
*The Illinois Nutrient Loss Reduction Strategy (NLRS) aims to reduce 45% of nitrogen and phosphorus loss to receiving waters in Illinois, with an interim goal of reducing 25% of phosphorus loadings and 15% of nitrogen loadings by 2025. Nutrient losses come from many sources, including point sources, urban stormwater, and the majority from agricultural and nonpoint sources. The NLRS tracks progress through tracking measures in the number of resources, amount of outreach, the land and facilities, and water quality. As part of implementing the NLRS, Illinois Farm Bureau's (IFB) efforts focus in four priority areas: 1) education and outreach to farmers, landowners and the general public; 2) supporting research of best management practices to reduce nutrient*

*loss from agricultural fields; 3) supporting farmer implementation efforts across the state; and 4) demonstrating progress toward the longterm goals of the NLRS. Highlights include overseeing the IFB Nutrient Stewardship Grant Program, supporting watershed planning efforts in priority watersheds across Illinois, engaging in partnerships to implement and research edge-of-field conservation practices, and collaborating with wastewater and drinking water facilities to research and demonstrate conservation practices. During this session, Dr. Omer will provide the details of IFB's work to improve water quality, as well as an overview of the lakes and watersheds in which IFB is working and lessons learned in the process. He will also offer suggestions for working effectively with the agricultural community in your area to promote voluntary adoption of best management practices.*

**Joshua D. Bruegge, Eastern Illinois University**
**Restoring Aquatic Connectivity in an Illinois River: Changes in Functional Groups of Fishes**
*Low-head dams serve as intermittent barriers to aquatic connectivity and alter habitats in the impounded reach directly upstream. In 2018 and 2019, two low-head dams on the Vermilion River and North Fork Vermilion River in eastern Illinois were removed. These removals restored lotic habitats and allowed fish passage to an additional 1,115 miles of upstream habitat within the basin. The Vermilion River basin is a diverse system inhabited by over 80 fish species with 28 of those species identified as Species in Greatest Need of Conservation. To assess the impacts of these dam removals, we conducted fish community surveys at 12 fixed stations both above and below two dam sites on the Vermilion and North Fork Vermilion rivers. Since 2012, we completed fish community surveys twice annually in the spring and fall using DC electrofishing. Fish collected were assigned a priori into functional groups using traitbased guilds. This trait-based approach allowed us to characterize the ecological processes of fish assemblages in the Vermilion and North Fork Vermilion Rivers. We analyzed fish and hydrologic data to assess changes in biotic diversity and functional organization of fish assemblages related to the dam removals. Cluster analysis and diversity metrics suggest that fish assemblages in the formerly impounded reaches are increasing in similarity to downstream assemblages after barriers were removed and the rivers return to a more lotic state. These findings can be applied to other systems to better understand the ecological impacts of improving habitat and connectivity.*

**Alexis VandenBerg, Eastern Illinois University**
**Impacts of an Instream Restoration on Fish Communities and Abundance in a Midwestern Stream**
*In the midwestern United States, streams are affected by a variety of anthropogenic disturbances which alter the structure and function of instream biotic communities. To mitigate these disturbances, stream restorations are implemented to increase habitat quality and ultimately improve the biotic integrity of stream ecosystems. The objectives of our study were to examine the long-term effects of an instream restoration of Kickapoo Creek (Coles County, IL) on fish community structure, abundance, and habitat quality. From 2009-2015, and again in 2021 we sampled fish communities in both restored and control reaches of the Kickapoo Creek using pulsed-DC barge electrofishing. Habitat quality was assessed at each site using the Qualitative Habitat Evaluation Index (QHEI), and fish diversity was compared among sites using Index of Biotic Integrity (IBI). Although, habitat heterogeneity and quality increased immediately following restoration, it took several years to see a shift in fish community structure and abundance, and IBI did not reach a maximum until six years post-restoration. Preliminary data from our most-recent survey in 2021 suggests the stream restoration continues to have positive effects on fish community integrity and habitat quality. Due to the previous delayed increase seen with fish community structure and abundance, researchers may find it beneficial to return to restored sites periodically. This will help them to better understand and monitor how the instream restorations affect the stream's biotic communities on a long-term basis.*

**Amanda Carter, Illinois Natural History Survey**
**Effects of Environmental Pool Management on 25 years of fish in backwaters of Upper Mississippi River Pool 26**
*Monitoring and restoration of biological diversity in the Upper Mississippi River has been a focus of the US Army Corps of Engineer's Environmental Pool Management (EPM) program. We analyzed a 25-year fish species abundance dataset maintained by the Illinois Natural History Survey to examine trends in fish*

*community structure in backwaters of the navigation pool near Alton, IL (Pool 26), with particular focus on potential effects of changes in water level management as well as invasive Asian carp. We selected four backwaters that differ in their distance from Melvin Price Locks and Dam that forms Pool 26. Fish data were standardized to prevent taxa with high catches from dominating the data set. The catch of each taxa for each year was divided by the maximum catch of that taxa over all 25 years. All taxa resulted in numbers from 0 to 1. We could detect no systematic effect of Asian carp abundance on fish community structure in these backwaters. However, EPM showed significant effect on fish community structure within the two middle backwaters treated separately and when all backwaters were treated as one community.*

**Andrew Margenot, University of Illinois**

**Legacy phosphorus and bank erosion: overlooked contributors to phosphorus loading of Illinois surface waters?**

*Non-point phosphorus (P) loss is a major contributor to Illinois surface waters, but its assessment and management are complicated by legacy P and bank erosion. Legacy P (i) in soils accrued from historical inputs and (ii) in stream channels from past sediment deposition can entail substantial lag times between implementation of P loss mitigation practices and reductions in P loads from non-point sources. Additionally, (iii) the non-agricultural source of bank erosion can contribute a significant portion of non-point P loads. Quantifying legacy P and its lag times as well as P loading via bank erosion is needed for accurate and resource-efficient P loss reduction practices and targets. To address these challenges, we draw upon agronomic P balances, soil testing trends, long-term (145 year) field experiments, historical soil archives and meta-analysis to estimate magnitudes and distribution of legacy P in soils and water bodies in Illinois. Preliminary results suggest that legacy P in soils can vary substantially at fine spatial scales, though statewide P balances raise the possibility of legacy P contributing to P losses. Legacy P in streambanks is more challenging to quantify, though its relationship to bank erosion offers a coarse means to bound potential magnitudes. Key areas for future research are determining residence times of legacy P and magnitudes of bank erosion.*

**Taylor Bookout, Illinois Natural History Survey**

**Illinois River Turbidity Response to Reduced Vessel Traffic**

*The Illinois River waterway is an important avenue for commercial vessel traffic between the Great Lakes and the Mississippi River. Vessel traffic has been shown to negatively impact phytoplankton and aquatic macrophyte production and foraging success in fishes through sediment suspension and shoreline erosion. From July 1- October 1, 2020, five Illinois River locks (Dresden, Marseilles, Starved Rock, Peoria, and La Grange) were simultaneously closed for repairs, substantially reducing vessel use. This offered a unique opportunity to observe a systemwide turbidity response to reduced vessel disturbance. Turbidity was measured at randomly-generated fish sampling locations in 2019 (pre-closure, n=893) and 2020 (n=1698) throughout the length of the river and across habitat strata (main-channel, side-channel, backwater). In general, turbidity increases downstream with changes in geomorphic properties of the river and increases laterally with higher turbidity occurring in backwaters than the main channel. A reduction in turbidity corresponded with a reduction in vessel traffic due to the 2020 lock closure for all reaches where traffic was limited. This reduction in turbidity was corroborated by three USGS stations that collect main channel turbidity data (Joliet, Seneca, and Florence) when accounting for differences in discharge between years.*

**Spencer J. Phillips, Illinois Natural History Survey**

**Evaluation of artificial nest structures and in-stream habitat of Flathead Catfish in the Rock River using radio telemetry**

*Pylodictus olivaris (Flathead Catfish), is a large piscivorous Ictalurid found in rivers and reservoirs in North America. Flathead Catfish reproduce in cavities, typically when water temperatures reach 19-24ºC. Although aquatic artificial structures can serve as refuge and aggregate fishes, their use to promote reproduction in cavity nesting species is less understood. The Rock River experienced an ethanol spill that resulted in the death of many sportfish, such as Flathead Catfish. In response IDNR installed 20 artificial nesting structures within the Dixon Reach of the Rock River to promote reproduction and recruitment. The aim of our study was to evaluate if the nest structures are being used by Flathead Catfish and identify other habitat and nest use*

*throughout the reach. Flathead Catfish (n=238) were tagged with VHF transmitters and manually tracked during the breeding season (May-August 2021) We located 65% (n=155) of tags in the 2021 tracking period. An interagency effort utilizing divers monitored by Aris sonar equipment supported that it is unlikely untagged fish are using the nesting structures. However, our results show that these fish heavily utilize the existing in-stream habitat within the river in the form of near-shore coarse woody debris and revetment. No tagged or untagged fish have been detected or observed using the structures, indicating a redesign of the nest structures coupled with additional monitoring may be needed.*

**Elizabeth Golebie, University of Illinois Urbana-Champaign**
**Overcoming Barriers to Invasive Species Prevention Behaviors through Values-framed Outreach Messages**
*Aquatic invasive species (AIS) pose negative threats to ecosystems and society on a global scale. Given that humans are responsible for transporting AIS on watercraft and equipment moved from one body of water to another, outreach campaigns to encourage recreational water users to stop the spread of invasive species have been ongoing. However, behavior change has been minimal. Thus, managers seek new research-based strategies to enhance outreach campaigns, including targeting deeper psychological processes such as values. The role of value-based messages in stimulating behavior change is a novel area of study that may allow for improved message design in AIS outreach. Therefore, we addressed the following research question: what is the efficacy of values-framed messages in forming recreational water user beliefs regarding AIS? We conducted an online survey of self-identified anglers and boaters across the state of Illinois. We asked respondents to evaluate experimental outreach messages, which reflected values that were self-focused (i.e., egoistic) or centered on other people or the environment (i.e., self-transcendent), alongside a brief control message. Participant evaluations of all three message types were positive and not significantly different. However, the self-transcendent message treatment indicated a stronger link between values and in-depth thinking about the messages concerning AIS - that is, participants with strong self-transcendent values were more likely to review the message closely when it was aligned with their values.*

**North Joffe-Nelson, University of Illinois Urbana-Champaign**
**Trust, Values and Behavior Regarding the Spread of Aquatic Invasive Species among Recreational Boaters in Illinois**
*Illinois waters are at risk of degradation from aquatic invasive species (AIS). These water bodies represent a valuable natural resource for recreational water users, who experience the negative effects caused by AIS but are also responsible for their inadvertent spread. Past work has shown that recreational water user decisions to avoid spreading AIS are due to long-term stable predictor variables, such as values, as well as short-term variables such as trust in regulatory and scientific communities. However, the interaction between these variables, specifically the moderating effects of trust on the value-behavior relationship, is understudied. Therefore, we conducted a state-wide survey of recreational boaters in Illinois and estimated a structural equation model to evaluate the relationships between values and behaviors. We also tested how those relationships were moderated by reported levels of trust in the IDNR and the scientific community. Our results suggest that biospheric and eudaimonic values both positively predict behavioral intentions, while altruistic negatively predicts those intentions, but we found no significant relationships regarding the moderating role of trust. We also provide insight on the demographic composition of self-identified boaters across the state; however, these findings raise questions about how standard sampling methods that rely on registration data miss a wide swathe of recreationists who are liable to inadvertently contribute to the spread of AIS. These findings underscore the importance of considering a range of factors in explaining the behavioral patterns of boat activities that pose risks for causing biological invasions in Illinois waterways.*

**Brian A. Metzke, Illinois Department of Natural Resources**
**Spatial Autocorrelation of Assemblage Composition Reveals Scale of Mussel Metacommunities**
*Spatial autocorrelation of community composition often is viewed as a statistical nuisance but can be used to identify scale of local and regional metacommunity processes and their underlying mechanisms. The hierarchical and branching structure of dendritic systems, like streams, imposes unique constraints upon*

*obligate communities by limiting dispersal pathways, compelling flowdirected dispersal, and exhibiting rapid increase in complexity of environmental setting over small spatial scales. We evaluate spatial autocorrelation of mussel assemblages by measuring similarity decay over Euclidean, watercourse, and flow-connected distance. We conduct a separate evaluation of similarity decay in headwater relative to mainstem streams. Patterns of mussel assemblage spatial autocorrelation are compared to those of fish assemblages. Results elucidate validity of extrapolating existing assemblage composition data to fill information gaps and the scale at which local assembly and metacommunity processes occur.*

**Steven E. Butler, Illinois Natural History Survey**
**Evaluation of a Quantitative PCR Screening Procedure for Rapid ID of Invasive Carp Eggs and Larvae in Ichthyoplankton Samples**
*Monitoring for reproduction of invasive carps often involves collection of large numbers of ichthyoplankton samples. Sorting and identification of eggs and larvae from samples entails considerable labor costs and may delay detection of spawning events for weeks to months. A quantitative PCR (qPCR) screening procedure has been developed to allow for more rapid identification of the presence of invasive carp eggs and larvae from ichthyoplankton samples. To assess the performance of this method when applied to an existing monitoring program, we used multiplexed qPCR screening to simultaneously assay for four invasive carp taxa and prioritize processing of samples collected in 2020 and 2021 from the Illinois Waterway. The number of DNA copies from invasive carp taxa was found to be a significant predictor of the presence of eggs or larvae in a sample. The quantity of organic matter in a sample, which could potentially bind to DNA and affect detections, was not found to alter this relationship. Classification accuracy of the qPCR procedure was high (92.6%), but specificity (96.6%) was higher than sensitivity (61.5%), suggesting that the risk of false negatives is higher than that of false positives. Continued assessment is needed to identify and control potential sources of error, but the qPCR procedure demonstrates potential for detecting invasive carp spawning events more rapidly than is possible with traditional processing methods. The species-specific information provided by the multiplex assays may allow for early detection of reproduction by individual species at the leading edge of their invasion fronts.*

**James K. Bland, EPS Inc., Highland Lake Management Committee**
**Trial Applications of Earth Tec QZ Molluscide for the Control of Zebra Mussel Populations in Ambient Waterways**
*There are over thirty lakes in Lake County that have been "infested" by zebra mussels (Dreissena polymorpha) ZMs. The ZMs interface with other lake problems including blue-green algae outbreaks, lake productivity, shifts in zooplankton and phytoplankton populations, and shifts in fisheries populations. The Lake County Zebra Mussel Project involves four programmatic elements: monitoring, trial applications of a commercial molluscicide, internship program for high school and college students and limnology education. At the present time there is no proven treatment for ZMs in ambient waterways. ZM monitoring (2019, 2020, 2021) and control applications (2020, 2021) were undertaken on Highland Lake. These trial applications were intended to establish efficacy and performance data for a new molluscicide, Earth Tec QZ. Goals of the application have been spatial control , not eradication. Methods included the setting of colonization plates, assessing cage mortality for adult mussels, gauging veliger populations with zooplankton tows and cross polarized microscopy, evaluation of expressed toxicity with the use of the Biotic Ligand model, and detailed tracking of copper concentrations. In general, the results have been positive and adult zebra mussels and veligers have come under control "spatially". While no formal risk assessment has been performed efforts have been made to determine impacts on nontarget species.*

**Andrew Runyon, University of Illinois Urbana-Champaign**
**An Experimental Assessment of Size-Specific Mollusk Vulnerability to Juvenile Black Carp (Mylopharyngodon piceus) Predation**
*The ongoing expansion of Black Carp (Mylopharyngodon piceus) populations throughout the Mississippi River basin adds urgency to our need to assess the vulnerability of mollusk communities within the expanding range of this invasive molluscivore. In particular, the feeding capabilities and subsequent ecological effects of juvenile Black Carp are not well known. We undertook a series of feeding experiments to quantify how shell size relative*

*to Black Carp mouth gape affects the vulnerability of various native and non-native mollusks to predation from juvenile Black Carp. Prey species consisted of native bivalves (Sphaerium sp.) and non-native bivalves (Corbicula fluminea and Dreissena polymorpha), as well as native snails (Elimia livescens and Physidae sp.) and non-native snails (Cipangopaludina chinensis). Black Carp were given 48 hours to consume different-sized individuals of a single prey species, with Dreissena trials having either attached or unattached individuals to assess the relative effectiveness of byssal thread attachment as a defense. We found that Corbicula had a narrow range of sizes vulnerable to juvenile Black Carp compared to the other bivalves, and unattached Dreissena were more vulnerable to predation than attached Dreissena. All snail species examined were relatively vulnerable, with Elimia less vulnerable than Cipangopaludina, and Physidae vulnerable at all sizes tested. These size-specific and interspecific differences in vulnerability provide information on which mollusk species may be facing increased predation from juvenile Black Carp and thus guide plans for mitigating the impacts of Black Carp on invaded aquatic communities.*

**Adam Landry, Eastern Illinois University**
**Investigating Bigheaded Carp Ichthyoplankton Presence in Tributaries of the Illinois River**
*Bigheaded carp (Hypophthalmichthys sp.) are a genus of invasive Asian carps that have spread throughout the Illinois River and its tributaries. They threaten the health of native ecosystems by competing with native species for resources and restructuring planktonic communities. Bigheaded carp can migrate long distances prior to spawning, and many of the tributaries of the Illinois River provide suitable spawning conditions for the bigheaded carp metapopulation. We have been monitoring for the presence of bigheaded carp larvae and eggs in three tributaries of the Illinois River since 2016. In addition, we have collected data on abiotic parameters such as temperature, water transparency, and dissolved oxygen. Our objectives are to compare the relative density of bigheaded carp larvae and eggs among the tributaries. Additionally, we will assess larval and egg densities across time to look for synchronous patterns among tributaries. We will also investigate the relationship between bigheaded carp larvae and egg densities with river conditions such as discharge. Previous results suggest that increased discharge, and greater watershed area correlate with higher abundances of eggs and larvae. Researching bigheaded carp reproduction in tributaries of the Illinois River is a necessary step in gaining a comprehensive understanding of the Illinois River carp metapopulation. This information may be useful to fisheries managers in determining which tributaries of the Illinois are most likely to provide alternate spawning habitat for Illinois River bigheaded carp.*

**Justin Kowalski, Southern Illinois University**
**Determining how Invasive Silver Carp Influence Trophic Structure of Native Species in the Ohio River**
*Invasive Silver Carp (Hypophthalmichthys molitrix) occur in a large portion of the Mississippi River basin and are threatening to expand their range. Understanding how this species affects the communities it invades will help managers mitigate negative impacts and predict how uninvaded communities may be affected. We determined how Silver Carp affect the isotopic niche and body condition of native fish at varying trophic levels along a Silver Carp invasion gradient throughout the Ohio River. Three Ohio River tributaries were selected per invasion category: establishment, invasion, presence, absence. In each tributary, stable isotope ratios of carbon and nitrogen were used to determine isotopic niche breadth and trophic position of native fishes. Additionally, relative weight was used as a proxy for body condition to evaluate the effects of Silver Carp on native species. Metrics evaluating population niche breadth were calculated to determine shifts in isotopic niche with increased Silver Carp abundances. Largemouth Bass and Gizzard Shad both had lower trophic position and relative weight, and larger niche breadth in the presence of higher abundances of Silver Carp. There was no difference for Smallmouth Buffalo and Bluegill populations. Silver Carp feed on plankton which is also an important part of the food chain for both Gizzard Shad and young Largemouth Bass and could explain why both species were negatively affected by higher abundances of Silver Carp. Our results suggest that Silver Carp may exert negative competitive effects and provide insight into abundances of Silver Carp that result in negative effects on native fisheries.*

**Austin Happel, John G. Shedd Aquarium**
**Decreases in Wastewater Pollutants Increased Fish Diversity of Chicago's Waterways**

*Throughout much of the globe, rivers are used to dispatch treated and untreated wastewater to the detriment of receiving ecosystems. Chicago represents one such city, within which sits a series of waterways whose flows are primarily controlled by effluent discharges from three large wastewater treatment plants. Random forest regressions were used to construct models which predict changes in fish species richness within the Chicago Area Waterways over a period of 35 years from data on water quality and weather. The average number of species found at any one location across the Chicago Area Waterway system increased from ~5 to ~12 between 1985 and 2019. The species additions were of species native to area, rather than new introductions. Decreases in wastewater effluents (i.e., phenols, fecal coliforms, and nitrogenous compounds), as well as wastewater storage capacity were identified as highly informative variables, allowing increases in species richness to be predicted with high accuracy. Weather variables were only important predictors in a section of waterway which does not receive wastewater effluent, although increases in annual rainfall and chloride concentrations within the waterways were noted. Increased rainfall events and harsher winter conditions (induces greater chloride runoff) threaten the progress made to lessen the effects of wastewater on the region. Improvements to how wastewater is treated, and subsequent reductions to harmful constituents of effluents, have improved the aquatic ecosystem and are likely responsible for the increased species richness over the 35-year timeframe studied.*

**Ben Lubinski, Illinois Department of Natural Resources**
**2020 Richland Creek Fish Kill - An Overview and a Site Revisit 1 Year Later**
*In September 2020 a substantial fish kill occurred on Richland Creek in St Clair County within the city limits of Belleville, IL. IDNR Fisheries biologists along with IEPA investigated this fish kill. The fish kill spanned approximately 2.3 miles of Richland Creek and resulted in an estimated 11,000 fish killed. A year later IDNR biologists returned to one of the stations and conducted a fish survey to re-evaluate the site of the fish kill.*

**Hannah Holmquist, Southern Illinois University**
**Fish Community Responses to Water Level Fluctuations in Buttonland Swamp, Illinois**
*Buttonland Swamp is located within the Lower Cache River watershed in Illinois that is inundated year-round. Human alterations to the watershed have substantially altered hydrology, including direction, timing, and volume of water flow through the riverine swamp. Diehl Dam, managed by Illinois DNR, was constructed to restore and control water levels in Buttonland Swamp. Duration and timing of inundation can influence fish movement and behavior. Infrequent fish sampling since 1992 limits understanding of fish-habitat relationships. To further understand how water level is affecting the fish community we are evaluating fish assemblage composition relative to habitat characteristics. Four macrohabitats were surveyed monthly from 2020-2021 using electrofishing, fyke, and minifyke nets. Microhabitats within these macrohabitats included open water, offshore vegetated, and nearshore vegetated habitats. Habitat attributes recorded include depth, substrate type, aquatic habitat refugia type, and vegetation type. Isolated ponds near the swamp were surveyed with mini-fykes to compare the assemblage structure with the swamp. Non-metric multidimensional scaling and analysis of similarities were used to evaluate changes in assemblage structure of fishes across habitat conditions and ponds. Indicator species analysis was used to identify prominent species driving spatial and temporal trends. Differences in assemblage structure and abundance between the ponds and swamp were evident as well as differences in Silver Carp, Shortnose Gar, Gizzard Shad, Bluegill, and Taillight Shiner among microhabitat types. Invasive species were associated with water depth more than native species. Results will inform management and facilitate further assessments of how hydrologic management regimes may affect the fish community.*

**Amber Blackert, Illinois Natural History Survey**
**Drivers of Fish Growth and Recruitment in Largemouth Bass, Bluegill, and Black Crappie in the Emiquon Preserve**
*The Emiquon preserve is a restored backwater of the Illinois River owned and managed by the Nature Conservancy, known for its recreational fishing, aquatic vegetation, and abundant migratory birds. Despite regular water level management to promote waterfowl and aquatic vegetation, its effect on sportfish growth and recruitment is not well understood. Little is known about how water level management and associated biological predictors affect fish growth and recruitment in the Emiquon preserve. Therefore, the aim of my*

*study was to determine how annual growth, mortality, and year-class strength of bluegill, largemouth bass, and black crappie are affected by water level management and food abundance at the Emiquon preserve. Age and yearly incremental growth were determined from sagittae otoliths (bluegill = ~361, black crappie = ~355, largemouth bass = ~376) collected in 2010, 2015, 2016, 2020, and 2021 to build a master chronology from the date of initial lake restoration. Linear mixed effect models were used assess annual growth and annual mortality and year-class strength were estimated from catch-curve and catch-curve residuals. Hopefully this data can help identify and inform management practices conducive to the growth and recruitment of Emiquon sportfish.*

**Shaley Valentine, Southern Illinois University**
**Resource Use of Bluegill along a Longitudinal Gradient in Five Reaches of the Mississippi River**
*In rivers, modifications such as dams alter the availability of resources (habitats and prey) through differentially affecting community structure and availability of habitat patches along longitudinal gradients. Specifically, among the Mississippi River Pools monitored by the Long-Term Resource Monitoring element of the Upper Mississippi River Restoration Program, the availability and identity of habitats and structuring of communities vary indicating that resource use of species may also vary longitudinally. Stable isotope analyses may be able to determine differences in resource use. Stable isotopes of carbon (C) and nitrogen (N) can vary spatially across a river's habitats and across prey sources by both trophic position and the environment prey inhabit. Thus, differences in stable isotopic ratios may indicate differential habitat and prey use. This study will use stable isotope ratios of C and N to determine the breadth of resources used within a reach and how that differs longitudinally in Bluegill in five reaches of the Mississippi River. Muscle samples from twenty Bluegill in each reach will be analyzed for C and N stable isotope ratios. Bayesian ellipses around the resulting ratios of δ13C and δ15N will determine the isotopic niche space as a measure of resource use and will be compared among reaches.*

**Jeremy Tiemann, Illinois Natural History Survey**
**Vitalogy: The Study of Life in the Vermilion River Basin**
*The Vermilion River basin encompasses nearly 4,000 km2 of eastern Illinois and western Indiana. It is one of the highest quality stream ecosystems in the Midwest in terms of aquatic biodiversity, with more than 100 fish species present. The basin experienced several anthropo¬genic disturbances in the late 1800s and early 1900s, including domestic sewage, industrial and agricultural pollution, impoundments, siltation, and channelization/dredging. However, those disturbances have subsided and the physicochemical conditions in the Vermilion River basin have improved, and subsequently, many portions are now considered 'Highly Valued Aquatic Resources.' As a result of these improved conditions, the fish assemblage appears to be recovering, including the range expansion of several rare taxa. This casual presentation will highlight recent projects occurring in the Vermilion River basin, including studying the spawning schedule of the state-threated Bigeye Chub and conducting a status assessment of the state-threatened Gravel Chub, which has an affinity for deep, swift flowing water and is often difficult to collect with traditional sampling methods.*

**David Kraft, PE, CFM, Hey and Associates, Inc.**
**Waterway Restoration and Climate Resiliency**
*Climate change and urbanization are forcing us to look at watershed and waterway restoration in more creative and resilient manners. Increased runoff and associated erosion and changes to our suburban and urban waterways must be addressed to avoid watershed issues, as well as address growing water quality concerns. Creative and innovative design and regulatory approaches are key to staying in front of this problem, while also seeking to restore resources and improve function. Many of our local communities have recently adopted the updated Illinois State Water Survey Bulletin 75, increasing design rainfall values by more than 30 percent for many storms. Beyond this empirical confirmation of increased discreet runoff events, we will also highlight the issues caused by the overall increase in rainfall depth on an annual basis. Through a series of project examples including large and smalls scale suburban and urban stream stabilization and restoration projects, Lake Michigan ravine and bluff remediation, and lake and pond shoreline restoration, we will highlight the impacts of climate change on these waterways. We will present and discuss innovative*

*stabilization approaches focused on biotechnical restoration, new products, and new implementation of tried and true favorites.*

**Qihong Dai, University of Illinois Urbana-Champaign**
**Assessments of Impacts from Climate Change and Agricultural Disturbances on Fish Biodiversity in the Kaskaskia**
*Global climate change and regional agricultural disturbance are two key drivers of freshwater community changes, particularly in the Midwestern US. Regional efforts of agricultural conservation practices have been implemented for conservation and restoration purpose, However, their effectiveness has not been thoroughly investigated. To effectively conserve and restore freshwater community, trait-based approaches to study functional organization provides mechanistic explanations and predictions of community changes. In this study, we used the Kaskaskia River Watershed, Illinois as an example to evaluate how water quality and environmental variables influence 1) historical species richness (SR) and 2) functional dispersion (FDis), where FDis was based on 1) life history and 2) physiology. The best random forest models showed that upstream watershed area, flow (mean, max, and sd), temperature (max and sd), and nitrate (min) were among the top predictors of historical community variations. We then used the best fitting models to predict impacts of climate changes on SR and FDis under 32 global circulation models. Our models predicted decreasing trends for SR and FDis, up to 22% and 4% by 2100, respectively, implying the homogenization of local freshwater communities. When potential agricultural conservation practices were combined with climate change, the decreasing trends of SR and FDis were not reversed, showing climate change outweighed potential agriculture conservation efforts.*

**Sara Ashcraft, University of Illinois Urbana-Champaign**
**Assessing Population Viability and Habitat Preference of Eastern Sand Darter in Illinois Running Waters**
*Routine monitoring of fish communities provides inadequate information about habitat, abundance, and distribution of Species in Greatest Need of Conservation (SGNC). This knowledge gap limits the management options for protecting and restoring SGNC. In the present study, we built habitat-suitability models for Eastern Sand Darters (ESD) in Illinois streams. ESD prefer natural sandbottom streams and thus could be stressed by sediment loading and flow alteration. We used seines to sample ESD in a watershed that is known to have a relatively strong population, the Embarras River. We sampled the darter community in areas where ESD were previously recorded, had not been detected, and presence was unknown. We included habitat and water quality measurements. Over two field seasons, 2018 and 2019, we surveyed 35 sites and recorded 368 ESD individuals. The habitat data was used to construct ESD habitat-suitability models. Random forest models at the reach level show our habitat data explained 23.61% of the variance in ESD abundance. Bedrock depth of 50 to 100ft in the total watershed, length of reach, and local watershed area were variables of importance at this scale. At the site level our habitat data explained 36.61% of the variance in ESD abundance. Cover type and amount of shallows in slow water, and percent riffle channel morphology were predictor variables of importance. The final models will be used to infer the distribution of the species in un-sampled streams and the stressors to ESD populations in the state and contribute to a conservation management or recovery plan.*

***Posters***

**Taylor Mogavero, James Garvey, Alison Coulter, David Coulter - Southern Illinois University Carbondale**
Factors affecting the movement of Silver Carp (Hypophthalmichthys molitrix) in the Illinois River

**Andrew T. Mathis, Brandon S. Harris, Kris A. Maxson, Levi E. Solomon, James T. Lamer - Illinois Natural History Survey**
Habitat use and gear selectivity of grass carp in three pools of the Upper Mississippi River System

**Valerie J. Thompson, Cassi J. Moody-Carpenter, Daniel R. Roth, and Robert E. Colombo - Eastern Illinois University**
Population trends of Channel Catfish Ictalurus punctatus in the Wabash River observed through standardized long-term monitoring

**Valerie Kuppek, Paul Stafford, Jason DeBoer, Andrya Whitten, James Lamer - Illinois Natural History Survey**
Is a fish in a river better than a canary in a coal mine?

**Carley Capon, Amber Blackert, Taylor Bookout, Mason Deja, Elizabeth Myers, Bradley Novak, Devlon Sutton, Kristopher Maxson, Levi - Illinois Natural History Survey**
Investigating the differences in fish assemblages associated with a unique main channel border habitat

**Octavio J. Silva, Alison A. Coulter, David P. Coulter, and James E. Garvey1 - Southern Illinois University and South Dakota State University**
Effects of three types of anesthesia on Silver Carp

**Lara Seek, Elizabeth Hamilton, and Hayden Wennerdahl - Illinois State Water Survey, University of Illinois**
High Water Marks: A comparison of annual runoff, sediment, and nutrient yields in small watersheds within the Illinois and Kaskaskia River basins

**Alison Siever, Elizabeth Golebie, Gregory Hitzroth, Amanda Huegelmann, North Joffe-Nelson, Carena van Riper – University of Illinois**
Analyzing presence and population density as spatial determinants of human behaviors that prevent the spread of aquatic invasive

**Kara Phelps, Kris Maxson, Jim Lamer, Kevin Ions - Illinois Natural History Survey**
Zooplankton production in a restored Illinois River backwater and its contribution to mainstem river zooplankton

**Clark Dennis III; Cory Suski - University of Illinois**
Can CO2 enhance the effectiveness of a bubble curtain to deter invasive carp?

**Hannah Holmquist, Greg Whitledge, and Jim Garvey - Southern Illinois University**
Evaluating Relationships Between Buttonland Swamp Hydrology and Fish Recruitment

**Estelle E Keigher, Josh D Bruegge, Alexis L VandenBerg - Eastern Illinois University**
Instream Restoration and the Impact on Two Riffle Habitat Specialists

**Patrick W. Padilla, Gregory W. Whitledge - Southern Illinois University**
Determining Potential Range Expansion of Black Carp in the Midwestern United States Through Otolith Microchemistry

# Upper Mississippi River fish population monitoring and sport fish assessment in west-central Illinois, 2020

F-193-R-07

Annual Report to the Illinois Department of Natural Resourcesand the
U.S. Fish and Wildlife Service

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Date of issue: July 22, 2021

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## EXECUTIVE SUMMARY

This report presents a summary of data collected during segment 07 (2020-2021) of the Upper Mississippi River fish population monitoring and sport fish assessment in west-central Illinois, an annual survey by staff of the Illinois Natural History Survey, with funds administeredby the U.S. Fish and Wildlife Service and the Illinois Department of Natural Resources.

Sampling for the program was conducted on 6 navigational pools of the Upper Mississippi River.All fishes collected were accurately identified, counted, measured, and weighed. The catch rates of several key species were calculated as the number of individuals collected per hour (CPUE ± standard error). Proportional size distribution (PSD) was also calculated for several key species. Catch rates and species varied among all sampling locations and sampling periods. Emerald Shiner and Gizzard Shad comprised most the individuals caught, and Common Carp and Channel Catfish accounted for the greatest proportion of the biomass collected.

### *Sport fish*

Catch rates and sizes of popular sport fish species varied greatly among the navigation pools sampled during 2020. Bluegill and Channel Catfish were the most-abundantly collected sport fish species in nearly all areas along the Upper Mississippi River, although Largemouth Bass and Smallmouth Bass also

appear to have robust populations. The slow but steady increasein White Bass CPUE since 2012 may warrant further investigation. Our long-term datasets allow us to observe substantial annual variations in the relative abundance and size distribution of many sport fish species, like Smallmouth Bass and White Bass. These observations could serve as a catalyst for future research investigating the effects environmental changes and management policies on the sustainability of Illinois' sport fish populations.

*Invasive Species*

Although the main focus of the F-193-R project is to conduct monitoring to improve our understanding of population dynamics, life histories, and habitat requirements of sport fishes, theprogram's sampling strategies are also useful for documenting trends in the relative abundance of non-native species occupying Illinois' large river ecosystems. Our surveys suggest Common Carp populations have declined across the region since 2009, which may be the harbinger of good things to come for native fish populations that have been negatively affected by Common Carp. However, Silver Carp populations (below L&D 19) have increased since 2012, which maycounteract any benefits native fish populations may have gained because of declining Common Carp populations. We advise that researchers be aware that our sampling protocols (e.g., restriction to main-channel habitats) may limit our probability of encountering the greatest densities of invasive species.

## ACCOMPLISHMENTS DEFINED BY F-193-R-07 WORK OBJECTIVES

*Objective 1: to annually conduct standardized pulsed-DC electrofishing to monitor the fish community and collect water quality data at 51 locations in pools 19, 20, and 21 on the UpperMississippi River.*

Nearly all the sampling for 2020 was completed on time, despite difficulties from the COVID-19 pandemic. Project staff continued field sampling until COVID-19-related issues required sampling be stopped in late October 2020. All 2020 Period 3 samples were completedexcept for 5 sites on Pool 19 (4 sites were completed on Pool 19).

*Objective 2: to annually quantify relative abundance, community composition, and size structureof fish communities using standardized electrofishing at 51 locations in pools 19, 20, and 21 on the Upper Mississippi River.*

This report provides estimates of relative abundance, community composition, and size structure of fish communities from Pools 19-21 of the Upper Mississippi River. This report alsoincludes a summary of Upper Mississippi River data collected for Pools 16-18 as part of F-101- R-32. These pools were included in this report to provide continuity and a comprehensive view of the Upper Mississippi River region.

**Long-term Survey and Assessment of Large-River Fishes in Illinois**

F-101-R-32

Annual Report to the Illinois Department of Natural Resources

Andrya L. Whitten, Jason A. DeBoer, Eric C. Hine, John H. Chick, and Jim T. Lamer

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Date of issue: August 23, 2021

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## EXECUTIVE SUMMARY

This report presents a summary of those data collected during segment 32 (2020-2021) of the Long-term Survey and Assessment of Large-River Fishes in Illinois (LTEF), an annual survey by members of the Illinois Natural History Survey, with funds administered by the U.S. Fish and Wildlife Service and the Illinois Department of Natural Resources. Sampling for the LTEF program was conducted on six reaches of the Illinois River Waterway and three segments or pools of the lower Mississippi River sampling area. A summary of the Upper Mississippi River data collected for Pools 16-18 as part of F-101-R-31 were reported in DeBoer and Lamer (2021) as part of the F-193-R-07 project report to provide continuity and a comprehensive view of the Upper Mississippi River region. In all segments of the LTEF program, all fish species collected were accurately identified, tallied, measured, and weighed. The catch rates of sportfish species were calculated as the number of individuals collected per hour ($CPUE_N$ ± standard error). Structural indices [Proportional Size Distribution (PSD) and Relative Weight ($W_r$)] were also calculated for several species of interest to regional managers. Catch rates and species varied among all sampling locations and sampling periods. Gizzard Shad and Emerald Shiner comprised the majority of the individuals caught, and Silver Carp and Common Carp accounted for the greatest proportion of the biomass collected in most sampling areas of the survey. Future analysis of $CPUE_N$ and PSD trends in sportfish populations sampled by the program may indicate inter-annual recruitment patterns or/and long-term trends in Illinois sportfish populations.

*Sportfish*

Catch rates and sizes of popular sportfish species varied greatly among the rivers and reaches sampled during 2020. The most-abundantly collected sportfish species were Bluegill and Largemouth Bass in the Upper Illinois River and Bluegill and White Bass in the Lower Illinois River. Flathead Catfish were the most-abundantly collected sportfish species on the Lower Mississippi River Sampling Area. Collections of black basses were greatest in the Upper Illinois Waterway. The catch rate of Smallmouth Bass in the Upper Illinois River SCB habitat decreased for the first time in four years to a catch rate similar to 2016. Our long-term datasets allow us to observe substantial annual variations in the relative abundance and size distribution of many sportfish species, like White Bass. These observations should serve as a catalyst for future research investigating the effects environmental changes and management policies on the health and sustainability of Illinois' sportfishes. Although the factors controlling the annual variations in the relative abundances of fishes in Midwestern rivers may be difficult to identify, our ability to detect and possibly explain such changes is dependent upon the execution of well-designed fisheries surveys. The operation and maintenance of the LTEF program and the data it generates can contribute to more comprehensive and nuanced understandings that can, in turn, aid in the development of more effective and sustainable management policies for sportfishes in the rivers of Illinois.

*Invasive Species*

Although the main focus of F-101-R programs are to conduct monitoring to improve our understanding of population dynamics, life histories, and habitat requirements of sportfish species, the program's sampling strategies may also be useful for documenting trends in the relative abundance of non- native species occupying Illinois' large river ecosystems. However, we advise that researchers use caution when interpreting the data we collect on invasive species as our sampling protocols (e.g., restriction to main-channel habitats) may limit our probability of encountering the greatest densities of the species in some instances. Our monitoring and analyses suggest densities of Silver Carp are greatest in the Lower Illinois River, and specifically in the SCB habitat. The body condition of Silver Carp in the Lower Illinois River increased to above the long-term average for both SCB and MCB habitats in 2020 with relative abundance remaining similar to 2019 compared to the highest relative abundance documented in the previous three years (2016-2018). In the Lower Mississippi Sampling Area, Silver Carp abundance decreased below the long-term average and body condition increased. Common Carp continue to contribute the greatest percent biomass while contributing to 4.9% of the total catch.

## JOB ACCOMPLISHMENTS DEFINED BY F-101-R-32 WORK PLAN

Job 1: *Prepare electrofishing equipment and train staff*

Project workers maintained and repaired electrofishing equipment as need throughout Project Segment 32. Full-time staff also trained seasonal staff members in the use of computerized data entry programs, electrofishing techniques, troubleshooting and repairing sampling gear, and statistical analysis of fisheries data.

Job 2: *Sample fish by pulsed-DC electrofishing on the Illinois and Mississippi Rivers*

Project workers completed all electrofishing assignments in the Illinois River and Mississippi River of Project Segment 32.

Job 3: *Update computer database*

All F-101-R Segment 32 (2020) project data were transferred to the project database and archived in fire-resistant file cabinets at the Illinois River Biological Station, Havana.

Job 4: *Analyze data*

Project staff used Segment 32 data to investigate trends in catch-per-unit effort and stock size indices to investigate spatial and temporal trends in fish populations. Those analyses are included in this report.

Job 5: *Presentation of results*

Project workers Jason DeBoer and Eric Hine presented the results of electrofishing sampling at numerous professional meetings (Appendix II). Project workers also completed the composition of the annual project report.