Wisconsin Chapter

American Fisheries Society

55th Annual Meeting
Radisson Hotel
La Crosse, Wisconsin

Oral Presentation Abstracts

Wednesday–Thursday
February 4–5, 2026

8:40 a.m., Wednesday

Screen Time: Effects of Forward-Facing Sonar on Angler Behavior, Smallmouth Bass Catch Rates, and Average Length in a Randomized Controlled Experiment

Greg Sass, Wisconsin DNR, gregory.sass@wisconsin.gov

Co-authors Maxwel V. Wilkinson, Kaden Ball, John Duvall, Adam Pickhardt, Bridger Wilson, Zachary S. Feiner, and Olaf P. Jensen

Research to date regarding the influence of advanced angling technologies such as forward-facing sonar (FFS) has shown mixed influences on species-specific angler catch rates. Most studies have either been observational or short-term experiments. None have examined how FFS affects angler behavior. We used a controlled fishing experiment during the summer of 2025 on Nebish Lake, Wisconsin to test for differences in 1) Smallmouth Bass *Micropterus dolomieu* catch rates; 2) mean and maximum length of Smallmouth Bass captured; and 3) aspects of fishing behavior between two experimental fishing teams with or without access to FFS. Two fishing teams of two anglers per team fished Nebish Lake six days per week in four-hour shifts; each team was allowed to use FFS for about four weeks while the other team was not. After the first four-week fishing period, FFS access was switched between the teams for about another four-week period. Overall, Smallmouth Bass catch rates were significantly lower for the experimental teams when they had access to FFS versus without it. Reduced catch rates were largely influenced by differences in individual team fishing behaviors (i.e., reduced linear distances fished, average boat speed, and increased turning angle) when allowed access to FFS. Mean length of Smallmouth Bass captured was slightly but significantly higher for the experimental fishing teams with access to FFS, whereas maximum length of Smallmouth Bass captured was minimally influenced by FFS. Differences in angler behaviors associated with FFS access appeared related to increased angler searching behaviors associated with targeting a pelagic portion of the Smallmouth Bass population during summer. Our findings do not support proposed FFS bans in response to fish conservation, accessibility, and fair chase concerns by anglers, stakeholder groups, and fisheries management agencies.

Full (20 min) presentation, professional

9:00 a.m., Wednesday

Emerging Technologies in Recreational Angling and Fisheries Management – Recent Advances and Current Directions

Robert Godfrey, Wisconsin DNR, robert.godfrey@wisconsin.gov

Co-authors Lauren Arrett and Dreux Watermolen

Emerging digital technologies are reshaping recreational angling and fisheries management, yet their ecological, social, and monitoring implications remain only partially understood. This literature review and key-informant study synthesizes recent research and expert perspectives on fish-finding sonar (including forward-facing sonar), underwater cameras, aerial drones, smartphone applications, and early uses of artificial intelligence in data collection and analysis. Using a comprehensive review of academic and gray literature from the past decade, plus written interviews with a select number of fisheries researchers and Wisconsin conservation wardens, our examination addressed two core questions: (1) to what extent are anglers adopting these technologies and how are they affecting angler enjoyment, expectations, and satisfaction?; and (2) how does technology influence catch rates, post-release outcomes, and the efficiency and design of creel and effort surveys? Evidence indicates that angler efficiency and catch rates have generally increased over recent decades, but experimental and creel-based studies show mixed and sometimes contradictory effects of sonar on catch rates. Technologies more reliably elevate expected success than actual catch. Equity, ethical concerns, "fair chase," and potential loss of natural refuges for large or vulnerable fish are highlighted. Emerging technologies create both risks and opportunities that can alter exploitation patterns and angler experiences. Simultaneously, these powerful new tools can offer cost-effective, higher-resolution monitoring when implemented with careful attention to ethics, governance, and co-production with anglers.

Full (20 min) presentation, professional

9:20 a.m., Wednesday

Effects of Front-Facing Sonar on Walleye Angler Catch Rates in Northern Wisconsin Fisheries

Kyle Hintz, UW-Stevens Point, khintz@uwsp.edu

Co-authors Dan Dembkowski, Jered Studinski, Dan Isermann, Joseph Hennessy, and Alexander Latzka

Walleye *Sander vitreus* support important harvest-oriented fisheries in northern Wisconsin and changes in angler harvest rates resulting from the use of forward-facing sonar (FFS) could have important implications for harvest management if use of this technology increases angler efficiency and catch rates. Previous studies with other species have reported mixed results regarding the effects of FFS on angler success. The objective of this study is to determine if catch rates of Walleye differ when specific anglers use a baseline sonar package (downscan and sidescan) versus using the baseline package and FFS. We will also determine if FFS increases Walleye catch rates relative to increases that might occur from repeatedly fishing the same lake with the baseline sonar package. To test these objectives, at least two anglers will fish five lakes in northern Wisconsin during May-October 2025 and 2026. Anglers will alternate between using the baseline sonar package and FFS on three of the lakes (Escanaba, Trout, and Minocqua lakes) which will address our first objective and allow us to calibrate catch rates between the two anglers. On the other two lakes (Big Arbor Vitae and Tomahawk lakes) each angler will be assigned only one of the two sonar options allowing us to test for the effects of FFS versus repeatedly fishing the same lake with the baseline sonar package. We expect anglers may have higher Walleye catch rates while using FFS, but the difference in catch rate between the two sonar types may vary among lakes and anglers and may decrease as an anglers become more familiar with a lake.

Full (20 min) presentation, student

9:40 a.m., Wednesday

Length at Maturity of Ceded Territory Walleye

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Co-authors Aaron Shultz, Adam Ray, Brandon Byrne, and Cory Suski

One widely encouraged practice for sustainable harvest of fish populations is to delay harvesting fish until they have a chance to 'spawn at least once'. Inland lake Walleye (ogaa; plural ogaawag) in the upper Midwest are harvested by tribal subsistence fishers and recreational anglers and these Walleye populations have been declining in recent decades across the region. A mix of regulations are used to control harvest in these populations, with some at least partially intended to protect Walleye until they are mature. Although biologists have a general idea of the lengths of mature Walleye from individual waters in spring surveys, specific parameters associated with length at maturity are not frequently estimated. We used length frequency information from spring population estimates to evaluate lengths at 50% and 90% maturity for Ceded Territory Walleye. We then compared the percent maturity values from individual lakes to the respective state Walleye harvest regulations in place on each lake. Mean length at 90% maturity for Ceded Territory lakes was 18.9" for female Walleye and 15.5" for male Walleye. These values were similar to those found elsewhere in the literature. Of the lakes where we were able to estimate length at 90% maturity, 45.7% had regulations that protected males and only 3.8% had regulations to protect females. These length at maturity estimates could be used to promote more sustainable harvest regulations for ogaawag.

Speed (10 min) presentation, professional

9:50 a.m., Wednesday

Diet Composition, Overlap, and Differential Effects of Largemouth Bass and Walleye Predation on Size Structure of Prey Populations

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Co-authors Greg Sass, Daniel Dembkowski, and Daniel Isermann

In recent decades, Largemouth Bass abundance has increased in some northern Wisconsin lakes with concurrent declines in Walleye recruitment and abundance, mirroring broader shifts in fish community structure and species dominance that are projected to occur in relation to changing climatic conditions. Although these species are piscivores, shifts in predatory species dominance from Walleye to Largemouth Bass could have important implications for prey fish community composition and size structure because of potential differences in diet composition and sizes of prey fish consumed by either predator. To better understand the potential top-down effects of shifting Largemouth Bass and Walleye abundance in northern Wisconsin lakes, our research objectives were to determine if: 1) diet composition and overlap of Largemouth Bass and Walleye vary in relation to fish size and season, 2) sizes of predominant ingested prey fish vary between Walleye and Largemouth Bass, and 3) shifts in predator species and size structure could influence size structure of Bluegill and Yellow Perch. We sampled diets from Largemouth Bass and Walleye in four northern Wisconsin lakes from May-October in 2024 and 2025. We observed moderate-high diet overlap between Largemouth Bass and Walleye, corresponding mostly with consumption of Bluegill and Yellow Perch by both predators. Largemouth Bass consumed larger Bluegill and Yellow Perch than Walleye, reflecting differences in gape limitation and size-selective predation between predators. Simulations based on the relative vulnerability of Yellow Perch and Bluegill to predation indicate that shifts in prey size structure in relation to predator species and size are likely; however, the magnitude of shifts in prey size structure was greater for Yellow Perch. Findings provide insight to potential cascading effects of changes in predatory species dominance on size structure of ecologically and recreationally important prey fish populations.

Speed (10 min) presentation, student

10:20 a.m., Wednesday

Diverse Waters: Angler Motivations, Demographics, and Behaviors Across Urban and Rural Wisconsin

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Co-authors Olaf Jensen and Zach Feiner

Recreational fishing is a globally important social–ecological activity, yet fisheries management has historically emphasized biological metrics while underrepresenting the human dimensions that shape angler behavior and ecological outcomes. Creel surveys are a foundational tool for assessing recreational fisheries, but their traditional design often overlooks variation in angler demographics, motivations, and behaviors, particularly across different fishing contexts. This gap is especially evident in urban fisheries, where anglers frequently fish from nontraditional access points and may differ substantially from rural anglers in access, effort, and reliance on fish for food. We examined recreational fishing as a social–ecological system by characterizing angler demographics, fishing effort, behaviors, and motivations across urban (Dane and Milwaukee counties) and rural (Vilas County) inland fisheries in Wisconsin. Using expanded creel survey data, we evaluated how fishing method (shore versus boat) intersects with geography to structure angler experiences. Specifically, we assessed whether angler behaviors and motivations are consistent across urban systems, how urban and rural anglers differ demographically and behaviorally, and whether demographic and behavioral traits predict fishing motivations across settings. We found that fishing mode strongly structured angler behavior and motivations within urban fisheries, with boat and shore anglers exhibiting distinct effort patterns and motivational profiles. Urban and rural anglers also differed in demographic composition, fishing activity, and motivations, indicating that fishing context influences both participation and fishing practices. Demographic factors such as race and income were consistently associated with angler motivations across systems. These results highlight the limitations of biologically focused creel surveys and demonstrate the value of integrating human dimensions into fisheries assessments.

Full (20 min) presentation, student

10:40 a.m., Wednesday

Getting to Know Urban Pond Anglers in Southeastern Wisconsin

Lauren Arrett, Wisconsin DNR, lauren.arrett@wisconsin.gov

Co-author Dreux J. Watermolen

The Wisconsin DNR and local governments cooperatively manage 64 designated urban community fishing waters in southern and southeastern Wisconsin to encourage and increase accessible angling opportunities for adults and youths who may not otherwise have the chance to fish in a metropolitan area. However, little research has explored the experiences or opinions of those who use designated urban fishing waters. To better understand urban pond anglers and assess the use of stocked fish species, we interviewed 108 anglers intercepted at 16 urban ponds in southeast Wisconsin. Our findings broadly characterize anglers at urban ponds; this includes angler motivations for fishing, satisfaction with their fishing experience, avidity for fishing, and targeted fish species. Information from this study serves to verify if and how stocked fish are used by the public and will increase our knowledge to better ensure all people are considered when future planning or decision making occurs.

Full (20 min) presentation, professional

11:00 a.m., Wednesday

Angler Use of Stocked Trout Lakes in Douglas and Bayfield Counties

Logan Cutler, Wisconsin DNR, logan.cutler@wisconsin.gov

Co-authors Samir Shaikh and Nate Thomas

Evaluating angler use is critical for deciding how to use limited hatchery resources efficiently. However, hiring full-time creel clerks is costly and usually infeasible, especially for small waterbodies with intermittent use by anglers. We used voluntary surveys at kiosks, paired with camera traps to estimate angler effort, catch, and harvest at 9 stocked trout lakes in Douglas and Bayfield counties of northwest Wisconsin. Anglers completed 279 surveys from May 2024 to January 2026. Voluntary reporting rate was 20%, and was generally similar among lakes, but higher during winter than summer. Angler effort, catch, and harvest were highly variable among lakes but similar between years. Angler reports also provided insight into over summer and over winter survival of stocked trout. Voluntary surveys paired with camera traps were a cost-effective approach to assess angler use and inform decisions on efficient use of hatchery resources.

Speed (10 min) presentation, professional

11:10 a.m., Wednesday

Postmortem Color Analysis of Eastern Banded Killifish (Fundulus diaphanus diaphanus)

Matthew Dougherty, St. Norbert College, matt.dougherty@snc.edu

Co-author Noah Cegelski

Body coloration is important for organisms because it can contribute to concealment, communication , and reproduction. Finding meaningful ways to quantify, isolate, and distinguish body color is important when studying intra- and interspecific variation, organism behavior, adaptation to particular environments , and more. While color analysis is used in various biological models, there are few studies outlining methods for measuring color in fish. Fish are a special challenge because they often change color when stressed or over time after death. Here, we offer a method to quantitatively measure color in the Eastern Banded Killifish *Fundulus diaphanus diaphanus*. These killifish are colorful fish native to the East Coast, USA, that have invaded Wisconsin waters, that undergo color dampening when stressed. We used RAW format cameras, a light box, digital grey cards, and Fiji software to measure color change of killifish after death in order build a protocol for analyzing intraspecific variation between killifish subspecies. We found that killifish colors stabilize between 800 and 1200 seconds after euthanization. Our results offer a protocol for researchers looking to quantitatively analyze color in a diverse array of organisms, especially those that experience color change when stressed, and gives insights into the timing when color analysis should be performed.

Full (15 min) presentation, professional

11:25 a.m., Wednesday

Life History Traits and Population Dynamics of Freshwater Drum Across Large River Gradients

Kristen Bouska, USGS, kbouska@usgs.gov

Co-authors Levi E. Solomon, Andrew D. Bartels, Steven A. DeLain, Eric J. Gittinger, Travis Kueter, Kristopher A. Maxson, John L. West, James T. Lamer, Hae H. Kim, and Quinton E. Phelps

Monitoring and assessment of nongame, native fishes are limited, but conservation interest in these species is growing. Freshwater Drum *Aplodinotus grunniens* are a wide-ranging species that serve important functional roles and could serve as an indicator for similar but less common species. Our overall objectives were to quantify and compare population dynamic rates and life history of Freshwater Drum among study reaches in the Upper Mississippi and Illinois rivers and relate these metrics to hypothesized environmental and anthropogenic factors. We integrated recently collected age data with monitoring data to estimate age and size distributions, growth curves, maturation schedules, mortality rates, and young-to-adult ratios of Freshwater Drum in six study reaches spanning 1500 river km. Principal component analyses and linear regression were used to relate environmental and anthropogenic gradients (latitude, commercial harvest, hydrologic dynamics, primary productivity) to life history traits and population dynamic rates. We found latitudinal gradients in life history traits and population dynamic rates whereby Freshwater Drum in upstream, higher latitude study reaches generally exhibited later maturity, slower growth, smaller maximum size, and lower mortality rates compared to those in lower latitude study reaches. Further, young-to-adult ratios positively corresponded with chlorophyll a concentration. No clear relationships were apparent between population dynamic rates and hydrologic variation or commercial harvest. Latitude is an important structuring component of life history traits and population dynamics of Freshwater Drum in the Upper Mississippi and Illinois Rivers likely due to both temperature seasonality and disturbance regimes. The presence of demographic structure in a widespread, common species such as Freshwater Drum suggests similar patterns likely exist in other long-lived native fishes.

Full (15 min) presentation, professional

11:40 a.m., Wednesday

Evaluating Lake Sturgeon Spawning Site Use and the Relative Contribution of Tributary Spawning Groups to Harvest in the Lake Winnebago System

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Co-authors Daniel J. Dembkowski, Margaret H. Stadig, Joshua K. Raabe, and Daniel A. Isermann

The Lake Winnebago System (LWS) population in east-central Wisconsin represents one of the largest self-sustaining populations of Lake Sturgeon *Acipenser fulvescens* in North America that supports an annual spearing fishery each February. Lake Sturgeon spawn at more than 70 locations within tributaries to the LWS, but the extent and timing of spawning at many sites remains unknown. Understanding the use of spawning locations is important in allocating sampling effort needed to mark fish and obtain population estimates used in setting safe harvest levels for the fishery. Furthermore, some spawning sites represent habitat improvement efforts implemented by the Wisconsin Department of Natural Resources (WIDNR) and little to no evaluation has been performed at these sites to determine relative use and potential for successful hatching. Our objectives were to describe Lake Sturgeon use, measure egg deposition rates and survival, and verify whether hatching is occurring at selected spawning locations in the Wolf River drainage, including sites where habitat improvements have occurred. Spawning sites were visited repeatedly during 2024 and 2025, Lake Sturgeon were visually counted along defined transects, and sampling for eggs and larvae was conducted. Relative use and hatching success varied among locations, and we documented larval production at several new locations. Additionally, the broad range of spawning sites used by Lake Sturgeon creates the potential for multiple discrete spawning groups with unequal vulnerabilities to harvest. We utilized the passive integrated transponder (PIT) recapture histories of harvested sturgeon to determine the relative contribution of spawning groups to spearing harvest to prevent the over-exploitation of particularly vulnerable groups. Our results may help the WIDNR strategically allocate spring sampling effort so that more sites can be sampled and could provide guidance regarding future habitat improvement projects.

Speed (10 min) presentation, student

11:50 a.m., Wednesday

Aquatic Macrophyte Communities Effectively Explain Sport Fish Community Structure in Temperate Lakes

Zach Feiner, Wisconsin DNR, zachary.feiner@wisconsin.gov

Co-authors Robert P. Davis, Ellen A. Albright, Catherine L. Hein, Michael R. Verhoeven, Jeremy Harstock, Erick Elgin, and Heidi M. Rantala

Lakes are managed for multiple uses and stakeholders, and management goals can sometimes come into conflict. Aquatic macrophytes provide key structural habitat in lacustrine ecosystems that influence fish reproduction, foraging, predation, and growth; however, these plants are often managed with other motivations (like recreation, aesthetics, or navigation). Siloed management of plants and fish can yield unintended consequences for fisheries, and a shift towards co-management could produce better outcomes. Here, we sought to understand relationships between macrophyte and sport fish communities in temperate lakes in the Upper Midwest. We analyzed macrophyte and sport fish communities using existing state agency surveys across 388 lakes in Michigan, Minnesota, and Wisconsin from 2004-2022. We used ordination-based techniques to understand co-variation between the two communities. Approximately 66% of the co-variation in the fish community was explained by macrophyte community composition, while only 28% of the co-variation in the macrophyte community was explained by the fish community. Fish communities were relatively well structured and organized along predictable gradients (e.g., centrarchid-dominant to percid-dominant) while plant communities were less clearly organized. We also found that macrophyte community composition was approximately equally as important as environmental variables in explaining variation in sport fish communities, while the physical structure of macrophytes explained less variation. Altogether, these results suggest that the co-management of macrophytes and fish could potentially improve fisheries outcomes in temperate inland lakes.

Speed (10 min) presentation, professional

1:00 p.m., Wednesday

Wisconsin's Trophy Muskellunge Fishery: What is it? How are we doing?

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Co-author Timothy Simonson

Muskellunge is an iconic, popular species in Wisconsin. About 25% of license holders fish for muskellunge, which is considered a "Trophy" by most anglers. The definition of "trophy" varies among individual anglers, but the consensus is fish > 45", with 50" or larger being the most common definition among surveyed anglers. Trophy fish are relatively rare, so measuring the success of trophy management is difficult. To evaluate progress, we examined several decades of available WDNR netting and creel data, as well as angler-reported data by Muskies, Inc., members, which have been shown to reflect WDNR survey data. Fish of "trophy" size were very uncommon among WDNR survey gears, but trends indicate increased catches since about 2000. Muskies, Inc., data also indicate that trophy catches have increased substantially over time and appeared to level off on Inland waters over the last 20 years. Survey data from outlying waters is very rare but Muskies, Inc. trophy catches have increased with the development of the Green Bay fishery. By all accounts, based on growth potential of inland waters, Trophy musky fishing has never been better and has likely "peaked". Outlying waters continue to improve (as evidenced by several new state release records, up to 57.5") and have the potential to challenge "modern" world records.

Full (20 min) presentation, professional

1:20 p.m., Wednesday

Checking in on Trends in Wisconsin Fish Populations and Our Pseudo-Standardized Monitoring Data

Alexander Latzka, Wisconsin DNR, alexander.latzka@wisconsin.gov

A first principle of adaptive fisheries management is to monitor fish populations to provide unbiased assessments of trends and to evaluate past actions so that we can update management accordingly. In other words, we depend on good data. But we rarely assess whether our data can tell us everything we expect them to. Here, I will assess what our data tell us about Wisconsin fish populations – the good, the bad, and the unknown – and will dive into how well our pseudo-standardized monitoring system works to meet our basic needs – the good, the bad, and the ugly. On inland waters, the state is currently completing about 1,800 surveys per year across 800 waterbodies. Sounds like a lot, but that's 25-30% less than what we were doing in the mid-2010s, and we have about 2,000 fishable accessible lakes, 13,000 rivers and streams spanning 80,000 river miles, and almost 30 gamefish and panfish species that are actively managed – so we have hundreds of thousands of fish populations to manage. Is our sampling enough to represent all populations? Meanwhile, we know many Walleye and brook trout populations are declining and centrarchid populations are increasing, but trends can be masked by interannual and inter-waterbody variation on top of simple measurement error. How well do the data capture these trends? Could there be other trends lurking that our data can't detect?

Full (20 min) presentation, professional

1:40 p.m., Wednesday

An Opportunity to Trade Time for Space Without Compromising Data Quality in Creel Surveys

Colin Dassow, Wisconsin DNR, colin.dassow@wisconsin.gov

Co-authors Stephanie L. Shaw, Olaf P. Jensen, and Greg G. Sass

Fisheries-dependent data (e.g., angler effort, catch and harvest rates) is important for understanding angler behavior and can be useful for managing some aspects of recreational fisheries. Yet, the collection of fisheries-dependent data through traditional point-intercept angler creel surveys is expensive and labor intensive. We evaluated model-based approaches to predict fisheries-dependent metrics, which may be more cost effective for fisheries management agencies trying to balance the need for creel survey information and fisheries-independent population monitoring. The analysis of 33 years of creel survey data pooled together generally found no difference between the estimates of fishery-dependent metrics from the current creel design and the five alternative creel designs using Bayesian p-values and Root Mean Squared Error. A year-by-year analysis of the same metrics also found no difference between the current creel design and the five reduced creel designs for most years (mean of 91.2% across metrics and scenarios). Of note though, the seasonal reductions in creel effort, while not significantly different from the current creel design, did perform worse than the percentage reductions that were applied evenly across the year. The five alternative creel survey designs reproduced key fishery-dependent metrics that were not different from the estimates obtained via the current creel survey design. This suggests that creel effort could be reduced without compromising critical estimates needed for the Walleye management system in northern Wisconsin and allow for more lakes to be surveyed on an annual basis.

Full (15 min) presentation, professional

1:55 p.m., Wednesday

A Reserve-Based Approach to Brook Trout Conservation in Wisconsin: Development and Application in the Peshtigo and Oconto Headwaters

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Co-authors Paul Cunningham, Chris Ester, and Bradd Sims

Wisconsin's native Brook Trout are an integral part of our natural legacy, our culture, and our identity. Brook Trout are also very sensitive to changes in water temperature. Currently, 21,283 miles of streams are suitable for Brook Trout in Wisconsin. Climate and stream models (FishVis) project a decline of 68% of the stream habitat for Brook Trout with, only 6,832 miles suitable for Brook Trout by the mid-century. Dealing with climate change will require the best available science and meaningful participation of public and private stakeholders. The WDNR Bureau of Fisheries Management has developed a Brook Trout Reserves Program to confront the challenges of climate change. Brook Trout Reserves are a selection of some of the places in Wisconsin where Brook Trout have the best chance of enduring the effects of climate change and other environmental perturbations. Landscape-level conservation planning conducted by the Brook Trout Reserves Team has identified 54 Brook Trout Reserves encompassing 205 subwatersheds. These strongholds represent the best Brook Trout populations and their habitat that will persist in the face of climate change. We further characterize existing and potential biological, environmental, and climatic threats among the reserves and suggest an adaptation framework for their management. The key management strategy for Brook Trout Reserve 41 (Peshtigo and Oconto Headwaters) is improving aquatic connectivity by removing barriers to fish passage, enabling Brook Trout to access and persist in coldwater refugia. A grant-funded Brook Trout Reserves Project Coordinator has convened a diverse group of stakeholders as a management planning team to develop a 10-year aquatic connectivity strategic plan for the reserve area. This presentation will highlight the progress of this collaborative team, including early planning outcomes, partnership development, and next steps toward implementation.

Full (15 min) presentation, professional

2:10 p.m., Wednesday

Instream Habitat Factors Influencing Mottled Sculpin (Cottus bairdii) and Slimy Sculpin (C. Cognatus) Occurrence Patterns in the Kickapoo River Drainage

Evan Sirianni, UW-La Crosse, sirianni5831@uwlax.edu

Co-authors Jason G. Freund and David A. Schumann

Freshwater sculpins fill important niches in coldwater stream systems worldwide. Mottled Sculpin *Cottus bairdii* and Slimy Sculpin *Cottus cognatus* were once abundant throughout Wisconsin Driftless Area streams. However, past agricultural practices altered these ecosystems and extirpated sculpin from many coldwater streams. Little is known about their basic ecology in the Wisconsin Driftless Area leaving knowledge gaps that could inform management practices. Our goal is to better understand the occurrence patterns of Mottled Sculpin and Slimy Sculpin within the Kickapoo River Drainage to support future management and reintroduction efforts. We sampled 60 randomly selected coldwater streams across five HUC 10 watersheds focusing on areas of known sculpin presence. Instream habitat and fish electrofishing sampling (i.e., 3-pass sculpin depletion or single pass efforts) were conducted in stream reaches defined as 35 times the mean wetted width. Instream and riparian habitat measurements included water depth (cm), bottom and average current velocity (m/s), percent substrate embeddedness, and substrate composition, in-stream macrohabitat, riparian and streambank vegetation, streambank cover and slope, and water temperature (°C). Imbalanced random forest modeling identified important occurrence drivers of Mottled Sculpin including watersheds, agricultural land use, and instream large substrate. Relative abundance patterns of Mottled Sculpin were positively influenced by instream macrophytes, and size was negatively influenced by water depth. Slimy Sculpin size was positively influenced by the proportion of mid-channel pool habitats, and the size structure of the adult West Fork Watershed sample population was made up of larger individuals compared to all other watersheds. Our findings provide a road map for future sculpin reintroduction efforts and give clues to important habitat considerations for both Mottled Sculpin and Slimy Sculpin.

Full (15 min) presentation, student

2:25 p.m., Wednesday

Bridging Groundwater and Surface Waters; Relationships With Brook Trout and Stream Temperature Suggest Northern White Cedar Serve as a Useful Indicator of Shallow Groundwater Flow

Zach Lawson, Wisconsin DNR, Zachary.Lawson@wisconsin.gov

Co-author Alex Latzka

Indicator species are important to a resource practitioners for a myriad of applications related to monitoring ecosystem condition and function, detecting change, and related decision making. Groundwater indicators are particularly important due to the difficulty and expense associated with directly measuring groundwater metrics. Brook Trout *Salvelinus fontinalis* may be the most common vertebrate groundwater indicator species, although various plants have been used for centuries to identify localized sources of groundwater. While Northern White Cedars (Thuja occidentalis) have long been directly linked to flowing groundwater in the forestry literature, the species has never been identified or broadly applied as an indicator in the aquatic realm. By triangulating electrofishing survey and temperature data from headwater streams in Wisconsin's Lake Superior Basin with existing forestry literature, we make a case for Northern White Cedar trees being a strong indicator of localized groundwater flow to surface water systems.

Full (15 min) presentation, professional

2:40 p.m., Wednesday

Drivers of Yellow Perch (Perca flavescens) Cohort Strength in Escanaba Lake, Wisconsin

Coco Eberhard, Wisconsin DNR, cocobass9@gmail.com

Co-authors Taylor Preul-Stimetz, Stephanie Shaw, and Greg Sass

Yellow Perch *Perca flavescens* are a key ecological and cultural species in northern temperate lake ecosystems and as a forage species they support important recreational fisheries. Recruitment success of percids has been linked to thermal conditions during early life stages, including growing degree days and variability in May water temperatures and ice duration. Yellow Perch are a primary forage species for Walleye *Sander vitreus*, an important gamefish species in Wisconsin. The abundance of Walleye is also likely a driver of Yellow Perch abundance over time. Yellow Perch and Walleye were sampled during 1990-2024 in Escanaba Lake, Wisconsin. All perch were measured for total length (nearest 0.1 inch). Age structures (scales) were sampled from a subset of fish (five per 0.5-inch bin). Abundance was estimated using mark-recapture methods with routine spring fyke-net surveys as the marking gear for each species. Recapture gear for Yellow Perch included recaptures returned through the compulsory creel harvest. The recapture gear for Walleye was nighttime boom electrofishing. The main objective of our study is to evaluate the extent to which environmental variables and/or Walleye abundance influence Yellow Perch year class strength and abundance in Escanaba Lake. The long-term dataset provides the opportunity to assess and strengthen data-driven analyses of Yellow Perch recruitment dynamics.

Speed (10 min) presentation, professional

2:50 p.m., Wednesday

Movements of Smallmouth Bass in the Little Wolf River after Failure of the Manawa Dam

Dan Isermann, UW-Stevens Point, diserman@uwsp.edu

Co-authors Dan Dembkowski and Elliot Hoffman

The Little Wolf River above Manawa Dam supports a population of Smallmouth Bass that was effectively isolated from bass below the dam. Failure of the dam in July 2024 allowed bass above the dam to move an additional 12 miles downstream and potentially enter the Wolf River. If these bass left and did not return or if the dam was closed before bass had a chance to return, the Smallmouth Bass fishery above the dam may decline. During September 2024, we implanted acoustic transmitters into 12 Smallmouth Bass captured above Manawa Dam and deployed a series of acoustic receivers to determine if these bass would move downstream through the failed dam structure and if they would eventually return to the segment of river above the failed dam. Additionally, we defined the timing of these movements to help inform potential repair of the dam. All bass moved below Manawa Dam during late September to mid-October 2024. All bass known to be alive returned upstream of the dam during late April to mid-May 2025. The failed dam structure does not appear to impede Smallmouth Bass migration in the Little Wolf River. If dam repairs were to occur, closure of the dam between June 1 and September 1 could ensure these migratory bass were back above the dam.

Speed (10 min) presentation, professional

8:30 a.m., Thursday

Lower Green Bay Area of Concern (LGBAOC) Aquatic Habitat Restoration at the UW-Green Bay Complex: Existing Conditions Review and Conceptual Design Development

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Co-authors Kyle Bretl, Brie Kupsky, Mandy Sharkey, Mandy Banet, Erin Giese, and Andrew LaPlant

The University of Wisconsin-Green Bay Complex encompasses Point au Sable Natural Area (265 acres) and Cofrin Memorial Arboretum (98 acres, lower 25-acre Mahon Creek corridor) within the Lower Green Bay and Fox River Area of Concern. Building on decades of conservation stewardship, these complementary sites support 13 of 18 AOC priority habitats and benefit 18 of 22 priority populations. This presentation focuses on GEI Consultants' 2025 Phase 1 assessment and conceptual design framework targeting aquatic habitat restoration for tributary fishes, stream macroinvertebrates, and native freshwater mussels. The sites provide complementary functions: Mahon Creek offers tributary spawning habitat with conditions indicating restoration potential, while Point au Sable, the largest remaining coastal wetland on Green Bay's eastern shore, contains high-quality native submergent marsh providing nursery habitat and exceptional hardwood swamp, though significant acreage requires invasive species restoration. Current limitations include channelization in agricultural headwaters, invasive aquatic vegetation displacing native communities, passage barriers restricting fish access, and watershed-scale nutrient loading. Site-specific challenges include bank erosion and limited instream cover in Mahon Creek, shallow water conditions at Point au Sable, and elevated sediment transport during storms. These conditions limit habitat function for spawning, nursery use, macroinvertebrate diversity, and mussel colonization. GEI's Phase 1 assessment integrates desktop review with 2025 field reconnaissance to inform conceptual restoration alternatives emphasizing riparian corridor enhancement, instream habitat complexity improvements, native vegetation restoration, and passage improvements. Phase 2 implementation is planned for 2027-2031, advancing AOC delisting objectives.

Full (20 min) presentation, professional

8:50 a.m., Thursday

Fish Monitoring in the Green Bay and Fox River AOC

Sam Schaick, Wisconsin DNR, samuel.schaick@wisconsin.gov

Co-author Jason Lins

In 1987, Lower Green Bay and the lower seven miles of the Fox River was listed as a Great Lakes Area of Concern (AOC) by the EPA. The main goals of rehabilitating the AOC were to remedy contaminated sediment, reduce non-point pollution, and enhance fish and wildlife habitats and populations. Sediment cleanup started in 2009 and finished in 2020. After sediment cleanup, various habitat projects were discussed and planned with the intention of improving habitat for fishes including basses, catfishes, musky, Northern Pike, Sturgeon, sunfishes, Walleye, Whitefish, and Yellow Perch. Starting in March of 2025, our AOC fisheries team began collecting pre-data to evaluate the success of various habitat projects and inform future habitat work. I will be discussing the history of the AOC, our projects, and fisheries monitoring program.

Full (20 min) presentation, professional

9:10 a.m., Thursday

Identifying Potential Sources of Natural Recruitment for Muskellunge in Green Bay, Lake Michigan

Ryan Eastman, UW-Stevens Point, ryan.j.eastman1@gmail.com

Co-authors Jason Breeggemann, Robert Davis, Daniel Dembkowski, and Daniel Isermann

Green Bay and its tributaries support a world-class Muskellunge fishery that attracts anglers from across North America, but there has been little evidence of natural recruitment, and the population remains reliant on stocking to sustain the fishery. Previous efforts to document natural recruitment have focused on the Fox and Menominee rivers where spawning is known to occur, with results suggesting that hatching success is limited. However, recent telemetry-based research and anecdotal observations indicate that spawning is occurring in non-tributary locations of southern Green Bay and the Sturgeon Bay area. These locations could represent important yet unconsidered sources of natural recruitment in Green Bay. Our objectives were to determine if: (1) successful hatching is occurring at open-water locations in Green Bay, including within the Sturgeon Bay area, (2) presence of eggs or age-0 Muskellunge at a location is related to a suite of habitat characteristics, (3) Muskellunge spawning in the Sturgeon Bay area contribute to the overall Green Bay population. Egg deposition and hatching success were assessed via intensive egg, larval, and juvenile sampling paired with habitat assessments. To assess contribution from Sturgeon Bay area spawners to the overall population, 20 adults captured in the Sturgeon Bay area during the annual spawning period were implanted with acoustic transmitters and monitored across the Green Bay acoustic receiver grid. Muskellunge eggs were collected at 14 of 312 sites across southern Green Bay and the Sturgeon Bay area, with egg deposition associated with shallow, near shore areas containing high substrate diversity. Nine age-0 Muskellunge were collected, all within the Sturgeon Bay area. These findings indicate that successful hatching and subsequent survival may be limited to the Sturgeon Bay area. Preliminary detection data suggests individuals spawning in the Sturgeon Bay area move south towards southern Green Bay following spawning.

Speed (10 min) presentation, student

9:20 a.m., Thursday

Muskellunge and Tiger Muskellunge Behavior in Escanaba Lake, Wisconsin

Tyler Hoffman, Wisconsin DNR, tyler.hoffman@wisconsin.gov

Co-authors Stephanie L. Shaw and Greg G. Sass

Muskellunge *Esox masquinongy* behavior is relatively unstudied, and to our knowledge, Tiger Muskellunge *E. lucius* x *E. masquinongy* behavior has never been studied. We tagged 11 Muskellunge and three Tiger Muskellunge with radio transmitters in the springs of 2024 and 2025 in Escanaba Lake, Vilas County, Wisconsin. We tracked these fish at least weekly during daylight hours during June-October in 2025. Our objectives were to determine if: (1) there were differences in core area size and usage between males and females, Muskellunge and Tiger Muskellunge, and by age; and (2) if Muskellunge and Tiger Muskellunge displayed territorial behavior within their core area ranges. Using the kernel density estimator, we calculated 90% home range and 50% core area values. Home range was defined as the area in which each fish had been detected, while core area was defined as the area(s) where each fish had been detected with the highest frequency within their home range. Tiger Muskellunge had larger average core areas than Muskellunge (66 vs. 36 acres), females had larger average core areas than males (62 vs. 35 acres), and < age-4 fish had larger average core areas > age-5 fish (54 vs. 37 acres). All fish had 100% overlap of their core area with between three and 12 other fish. Our findings suggest that preferred Muskellunge and Tiger Muskellunge habitat may be somewhat limited given relatively high overlap in core area use between tagged fish. Ongoing acoustic tagging and tracking of Muskellunge and Tiger Muskellunge may elucidate finer scale habitat and movement patterns of these species, as well as year-round behavior.

Speed (10 min) presentation, professional

9:30 a.m., Thursday

Tracking Fish Movements: Development of the Riverine Acoustic Fish Telemetry (RAFT) Network

Sierra Schuster, USGS, sschuster@usgs.gov

Co-authors Danila Fedorenko, Aaron Murphy, Benjamin Schlifer, Doug Appel, Andrea Fritts, and Marybeth Brey

Fish movement data generated by acoustic telemetry is used in many research and management activities, such as planning control efforts for invasive carp. Although the tracking of fish in river systems often crosses geographic and bureaucratic boundaries, these large datasets can remain isolated within individual agencies spread across a wide geographic area. This can make it difficult for researchers to discover or access data necessary for building complete fish movement histories. The USGS developed the Riverine Acoustic Fish Telemetry (RAFT) Network to centralize and standardize data from fish tracking projects that are spread across different agencies and locations throughout the Mississippi River Basin. The RAFT Network supports collaborative research and fish tracking by integrating features for data sharing, visualization, and analysis. By partnering with the Ocean Tracking Network (OTN), RAFT leverages established data standards and infrastructure to streamline development and links with a worldwide network of fish tracking groups to expand our geographic reach. The RAFT Network currently contains hundreds of millions of detection records and is publicly accessible at https://usgs.gov/apps/raft. For this presentation, we will discuss RAFT's development history, demonstrate RAFT's capabilities for data management, highlight examples of how researchers are using RAFT to study invasive carp and native species, and discuss opportunities for collaboration.

Full (20 min) presentation, professional

9:50 a.m., Thursday

Defining Connectivity Among Smallmouth Bass Spawning Locations in Green Bay Using Acoustic Telemetry and Genomics

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Co-authors D. Dembkowski, S. Hansen, T. Zorn, Z. Slagle, P. Euclide, J. Homola, and D. Isermann

Smallmouth Bass *Micropterus dolomieu* populations support destination fisheries across the Great Lakes region; these fisheries are sustained by aggregates of bass that spawn in several different locations and habitat types. The connectivity among these spawning aggregates has not been thoroughly investigated, and this connectivity may be disrupted by displacement of fish during tournaments. Understanding natural connectivity among spawning aggregates and the potential effects of tournament displacement is critical for defining appropriate scales for management. We are using a combination of acoustic telemetry and genetic analysis to evaluate spawning site fidelity, post-spawning dispersal, behavior after displacement, and ecotypes of bass spawning in tributaries (resident vs. transient). In May of 2023, acoustic transmitters were implanted in 210 Smallmouth Bass across seven identified spawning locations (n = 30 at each site) in Green Bay, and in two tributaries of Lake Erie (n = 30 at each site). In May 2024, 60 additional Smallmouth Bass were captured in two Green Bay harbors (n = 30 at each site), implanted with acoustic tags, and released at a third location (Sawyer Harbor) approximately 25-45 km from their original capture sites to assess post-displacement behavior. Fin clips were taken from all tagged fish for genetic analysis. Detections of tagged fish are downloaded from acoustic receivers annually. Preliminary analyses indicate that harbor-based spawning site fidelity in Green Bay is high (approximately 80% on average) and higher than tributary-based fidelity (approximately 60% on average). The majority of Green Bay Smallmouth Bass stay within 20 km of their original capture location. Most Smallmouth Bass that spawn in Green Bay and Lake Erie tributaries leave the rivers at some point throughout the year (e.g., transients). Most (75%) displaced Smallmouth Bass returned to their initial capture location within four months.

Full (20 min) presentation, student

10:30 a.m., Thursday

Optimizing Underwater Camera Sampling to Assess Overwintering Backwater Fish Habitat on the Upper Mississippi River

Ben Patschull, UW-La Crosse, patschul.benjami@uwlax.edu

Co-authors Dr. Ross Vander Vorste, Dr. David Schumann, Dr. Patrick Kelly, and Dr. Kristen Bouska

Gear limitations imposed by ice conditions in temperate regions have created a significant knowledge gap regarding the winter habitat use of the backwater fish assemblage. We developed and optimized an underwater camera method for under – ice sampling in four freshwater backwaters on the Upper Mississippi River. We found that site depth ($\sum wi = 1.0$), water clarity ($\sum wi = 0.99$), snow depth ($\sum wi = 0.89$), and ice depth ($\sum wi = 0.86$) were the main factors influencing camera viewing distance. Rarefaction analysis showed 21 sampling sites per backwater and 15 – minute recordings sufficiently captured species richness and relative abundance. Using this optimized underwater camera method, we evaluated the effect of environmental factors on fish assemblage metrics (i.e., species richness and combined MaxN) and species – specific data for Bluegill, Largemouth Bass, and Yellow Perch using random forest modeling. We found that water temperature (°C) and dissolved oxygen (mg/L) were the most important factors influencing fish assemblage metrics and the species – specific data for Bluegill and Largemouth Bass presence and relative abundance. We also found that filamentous algae presence had a negative relationship with Bluegill relative abundance, and that site depth (m) and conductivity (µS) were the most important factors influencing Yellow Perch presence and relative abundance. Our random forest results support management strategies that limit backwater sedimentation to mitigate the growth of filamentous algae in shallow water depths (< 2 m). Water temperatures > 2 °C, dissolved oxygen levels between 5 - 10 mg/L, and low filamentous algae production are likely factors that provide adequate overwintering habitat for the wider backwater community; however, we found that the environmental factors influencing Yellow Perch habitat use (i.e., site depth and conductivity) differed. The results of this study provide managers with expanded knowledge of overwintering fish dynamics.

Full (20 min) presentation, student

10:50 a.m., Thursday

Rockin' Rock Bass: An Age and Growth Study

Abigail Buzdon, Ohio Northern University, a-buzdon@onu.edu

Co-authors Noah Lottig, Carol Warden, Paul Schramm, and Quinnlan Smith

Rock Bass *Ambloplites rupestris* are a warm-water centrarchid found in freshwaters across east-central North America. For the last four decades, the North Temperate Lakes Long-Term Ecological Research (NTL-LTER) program has been monitoring Rock Bass populations as well as all other species found in seven northern Wisconsin study lakes. Individual and population level data were collected using a variety of gear including fyke nets, trammel nets, gill nets, and electrofishing annually during July and August since 1981. In addition to data such as length and weight, scales were collected and preserved from two Rock Bass within each 5mm size class. We analyzed age and growth dynamics of Rock Bass populations in four lakes (Trout, Sparkling, Big Muskellunge, and Allequash) on 5-year intervals starting in 1984. Results suggest that Rock Bass are growing larger and reaching their theoretical maximum average length faster than previously seen and the changes in these parameters appear to be associated with concurrent increases in water temperature. This could be indicative of similar patterns in other centrarchids, showing that climate change is causing large-scale food web alterations and changes in food availability for important gamefish in the North Temperate Lakes.

Speed (10 min) presentation, student

11:00 a.m., Thursday

The Lake Superior Fish Community – A Game of Thrones

Dray Carl, Wisconsin DNR, dray.carl@wisconsin.gov

As the wise Tyrion of House Lannister once said, "Trout, Whitefish, Lamprey, Smelt – they're all just spokes on a wheel. This one's on top, then that one's on top, and on and on it spins." Over the past century, the only thing certain in Lake Superior's fish community has been the inevitable rise and fall of different families, both foreign and native. In the year 1972, renowned biologists Lawrie and Rahrer recounted the demise and eventual usurpation of the native houses of the realm after invasions by foreign adversaries and overall misuse of resources by the local populace. Three decades later, Bronte et al. chronicled the restoration of power to the native houses, led by their rightful leader, the Lake Trout (aka House Stark), dubbed "The King in the North!" Here, I will tell chapter three of the story - the state of the realm over the past two decades under the reign of Lake Trout, based upon the writings of Goldsworthy et al. and Edwards et al. in the year 2025. These accounts feature the fortune of Lake Whitefish (House Lannister) and Ciscoes (House Greyjoy), the ongoing battle against Sea Lamprey (White Walkers), the plight of Nonnative Salmonines (House Targaryen) and Rainbow Smelt (Dothraki), and the renewed focus on restoration of the native imperiled families of Lake Sturgeon (Children of the Forest) and Brook Trout (Wildlings). Henceforth, we proclaim the period of 2001-2022 the "Era of Stability" under the rule of Lake Trout, who continue to buffer the other houses from Sea Lamprey predation and suppress the negative effects of Rainbow Smelt. However, no ruler is without its rivals, and threats to the realm are numerous including invasive Dreissenid mussels, a changing climate, and habitat restoration.

Speed (10 min) presentation, professional

11:10 a.m., Thursday

An evaluation of Cisco condition in Wisconsin waters of Lake Superior

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Co-authors Brad Ray, Dray Carl, Ian Harding, Scott Sapper, Chris Zunker, and Lynn Waterhouse

Commercial harvest of Cisco *Coregonus artedi* in Wisconsin waters of Lake Superior has increased due to the emergence of a commercial roe fishery resulting in a need for a more comprehensive understanding of body condition of the stock. Various fishery independent surveys are conducted during summer months and winter spawning aggregations that can provide insight into Cisco somatic and gonadal development throughout the course of a year. While the average weight of an individual is currently incorporated into the quota setting procedure, additional exploration of potential differences in Cisco condition in relation to sex and maturity may provide fishery managers with a more thorough understanding of sources in annual variability in this metric and how it may influence the quota setting process. The purpose of this work is to 1) explore the weight-at-length of Cisco captured in monitoring surveys to identify differences in condition based on sex and maturity and utilize these relationships to 2) build bioenergetic models to explore the potential for condition to vary in response to changes in consumption or the environment. Preliminary results indicate variation in condition between males and females as well as among maturity states. These findings can be incorporated into the quota setting procedure to help ensure consistent application of weight-at-length relationships for determining standing stock biomass.

Full (15 min) presentation, student

11:25 a.m., Thursday

Salmonid Movement and Habitat Use in Minnesota Tributaries to Lake Superior

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Co-authors Dr. Justin VanDeHey, Dr. Joshua Raabe, Nick Peterson, and Cory Goldsworthy

Minnesota tributaries to Lake Superior are relatively groundwater-limited, and climate change is forecasted to significantly reduce fluvial cold-water habitats in these streams. Native Brook Trout Salvelinus fontinalis, and non-native Steelhead Oncorhynchus mykiss depend on cold, fluvial habitat for at least a portion of their life, but knowledge is limited regarding the habitat use of these Salmonids especially during periods of stressful water temperatures and extreme flows. Therefore, our research aimed to 1) identify critical habitat (i.e. thermal refugia) for Salmonids across two watersheds, and 2) determine if movements of Salmonids were related to water temperature and discharge. Salmonid movement was investigated in the Knife and Stewart River watersheds using 16 PIT arrays and radio telemetry. Between 2024 and 2025 we PIT tagged 1,010 Brook Trout and 3,060 Steelhead and implanted radio transmitters in 42 adult Brook Trout and 18 Steelhead. Water temperature discharge data were collected by loggers dispersed across watersheds and stratified among sub watersheds. Summertime water temperature profiles in the lower reaches of the Knife River periodically surpassed the lethal threshold for Brook Trout, indicating an ephemeral thermal barrier between headwaters and Lake Superior. Movement of Brook Trout was minimal for most of the study period, increasing only during the fall spawning period. However, some adult Brook Trout used more productive lower river habitat in the spring and early summer but sought headwater tributaries with groundwater influence and overhead cover when water temperature peaked and flows decreased. Juvenile Steelhead generally used all habitats in the Knife River regardless of water temperature and flow regime. By identifying critical habitat and understanding habitat limitations for Salmonids in these watersheds we will help inform habitat conservation and restoration in the face of climate change.

Full (15 min) presentation, student

11:40 a.m., Thursday

Ecopath with Ecosim: Ecosystem Impacts of Bighead and Silver Carp Control

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Co-authors Richie Erickson, Tyler Butts, Steve Chipps, and Alison Coulter

Invasive bigheaded carp *Hypophthalmichthys* spp. compete with native planktivores in the Mississippi River and affect multiple trophic levels in the ecosystem. Ecopath with Ecosim (EwE) is modeling software that uses mass-balance trophic relationships to examine changes in trophic ecology and can be applied to assess removal strategies of invasive fishes. The focus of invasive carp removal has been on the adult individuals in the population, but we use an EwE model to explore the ecosystem effects of juvenile removal compared to adult removal in Pool 26 of the Mississippi River. The input data for this model came from a variety of sources such as literature values, empirically derived data, and long-term ecological datasets. After inputting the data, values were then adjusted to balance the model in the following order: production/biomass ratios, consumption/biomass ratios, biomass values, and diet compositions of fish groups. Once the model balanced, we ran the following scenarios in Ecosim (1) removal of adult bigheaded carp only, (2) juvenile only, and (3) a combined removal. Various levels of removal were tested with all scenarios: 1x (current harvest levels), 2x, 5x, and 10x. The scenario outcomes varied in effectiveness. The most effective removal method overall was combined removal, followed by adult removal and then juvenile removal as the least effective. Current harvest rates had a positive ecosystem effect in the combined removal scenario only; otherwise, higher levels of removal were required for an ecosystem response of native fishes. Use of EwE will complement ongoing and future modeling efforts for the control of invasive carps in the Mississippi River.

Full (15 min) presentation, student