Illinois Centrarchid 2023 Summary- Andrya Whitten

Illinois Department of Natural Resources (IDNR) Management and Research:

Nerissa McClelland, Illinois Department of Natural Resources

River	stocking location	species	size (in)	number	stocking date
Illinois River (ILR)	Spring Valley Barto Landing Ramp	Smallmouth Bass	4.3	2470	8/15/2023
Illinois River (ILR)	Morris Boat Ramp-Stratton Park	Smallmouth Bass	4.3	2660	8/15/2023
Illinois River (ILR)	Seneca Boat Ramp	Smallmouth Bass	4.4	2127	8/11/2023
Illinois River (ILR)	Ottawa Boat Ramp-Allen Park	Smallmouth Bass	4.4	1953	8/11/2023

Trent Thomas, Illinois Department of Natural Resources

A Redspotted Sunfish (*Lepomis* miniatus) Species Status Assessment and Planning Document were completed this year. These documents will be used to guide future conservation and recovery efforts.

University Research:

Dr. Cory Suski, University of Illinois Urbana-champaign

The UIUC Eco-Physiology Lab, lead by Dr. Cory Suski, has been busy with several centrarchid-related research projects in 2023, specifically involving the impacts of tournament angling on Largemouth Bass. One study, lead by PhD student Shasta Kamara, sought to quantify the severity of physical injury, reflex impairment, and latent mortality caused by cull tags commonly used by Bass tournament anglers. This was done by assessing bodily injury before and after applying cull tags to fish. Reflex action mortality predictor (RAMP) scores were evaluated after holding in a simulated livewell and after latent mortality was estimated by holding the individuals in a net pen post-treatment. Results from this study showed that while no mortality or behavioral impairments occurred, the application of cull tags results in increases in injury to largemouth bass. In addition, a startling number of largemouth bass collected from the reservoir had a pre-existing jaw injury, presumably from being previously captured in a tournament.

Additionally, MS student Allison Hay has been working on two sperate projects with largemouth bass. For one project, Allison has been maintaining acoustic arrays in Clinton and Newton Lakes and deploying acoustic tags in tournament-caught Largemouth Bass. The objective of this work is to quantify post-release movement and residency of these individuals. Results from this work are currently being processed. In the second study, Allison worked with Jake Wolf Memorial Fish Hatchery to collect data that will be used to quantify the physiological responses of Largemouth Bass to capture and livewell holding. This was done by exercising individual largemouth bass to exhaustion, then holding them in a simulated livewell to recover for 6-8 hours. The fish in these trials were subjected to different temperature treatments meant to simulate trends observed in angler's livewells (i.e., temperature gradually increasing, ice added, etc.). After recovery, fish were assessed for a RAMP score, and had a small amount of blood drawn which will be used to conduct several different laboratory assays this Winter.

Indiana Centrarchid 2023 Summary- Kevin Gaston

Centrarchid Technical Committee Indiana Report – December 2023 North Central Division American Fisheries Society The following reports have been collected from the membership of the Indiana Chapter of the American Fisheries Society, and summarize the major centrarchid-related research, management strategies, monitoring, and conservation efforts going on across the state of Indiana. Indiana Department of Natural Resources Monroe Lake Crappie Survey IDNR District 5 fish management conducted a crappie survey at 10,750-acre Monroe Lake, Monroe County on March 6 to March 8, 2023. Standard Crappie surveys statewide are considered a status and trends survey by species. Sampling effort consisted of 2 Michigan Style trap nets, which were fished two nights prior to running. Water temperature while setting nets was 49F. Calculated as 4 overnight lifts we collected a total of 1,716 White Crappie for a CPUE of 429 fish/lift. The length range was 5.2 to 13.3 inches. A sub sample of White Crappie were aged with otoliths and ages 2 to 11 years old were represented. The average age of the White Crappie collected was 5.3 years old. A total of 519 Black Crappie with a CPUE of 130 fish/lift was collected. The length of range was 5.1 to 8.4 inches. Ages 1 to 8 years old were represented in the catch. The average age of Black Crappie collected was 3.5 years old. Report Contributors We thank David Kittaka (IN DNR) for his contribution to this report.

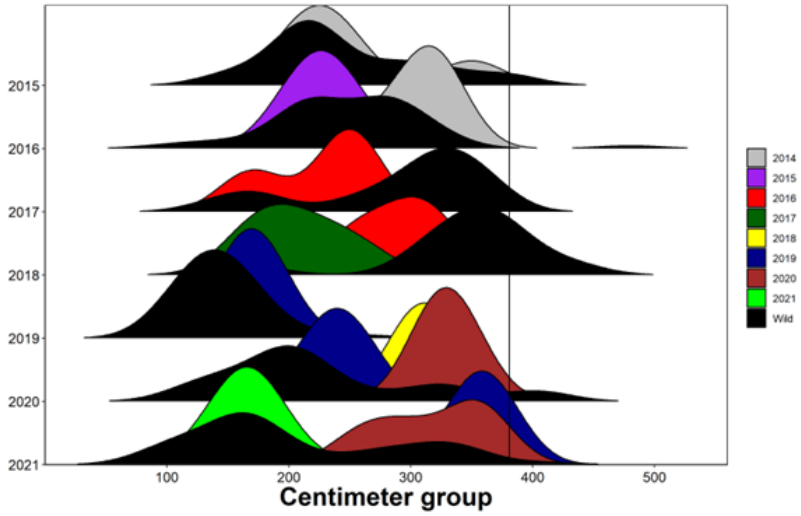
Kansas Centrarchid 2023 Summary- Jim Miazga

Stocking evaluation of early-spawned Largemouth Bass fingerlings
Jeff Koch, Ben Neely, Jim Miazga, Dave Spalsbury, Connor Ossowski, Craig Johnson

Kansas Department of Wildlife and Parks has been stocking fingerling Largemouth Bass produced with early season spawning since the early 2010s. Progenies are genetically marked and stocked into impoundments which are sampled in subsequent years to evaluate success of these stockings. Stockings have contributed to Largemouth Bass populations at varying levels, and the most successful stockings seem to occur when habitat conditions are conducive to

recruitment of juvenile and adult Largemouth Bass. In 2023, five populations were sampled and contribution of stocked fish and according to year classes are shown in the table below. Stocked age-1 Largemouth Bass seem to have a larger size than their naturally spawned cohorts. Size of stocked fish can be tracked throughout their lives using ridgeline plots like the one constructed for Melvern Reservoir seen below.

Impoundment ID	Stocked year class or Wild	# caught
BNCL	2022	1
	Wild	71
CDBR	2019	6
	2020	1
	Wild	93
CRSL	2020	1
	2022	2
	Wild	85
ELDR	2020	1
	2021	3
	Wild	20
MELR	2013	1
	2017	1
	2019	5
	2020	3
	2021	6
	2022	1
	Wild	44



The Influence of System Characteristics and Biotic Interactions on White Crappie Population Dynamics in Kansas Impoundments
Jim Miazga, Zach Klein, Jeff Koch, Ben Neely

In Kansas, crappie *Pomoxis* spp. (White Crappie *P. annularis*, Black Crappie *P. nigromaculatus*) fisheries have important social and economic value, making management of these species a high priority. However, management of crappie fisheries is often challenging due to a paucity of information regarding the specific dynamics regulating populations. Even when population dynamics information is available, the relative influence of exogenous factors on crappie populations is poorly understood. In an effort to improve the management of crappie fisheries, we sought to: 1) describe White Crappie population dynamic rates throughout Kansas and 2) assess the influence of exogenous factors (i.e. system characteristics and biotic interactions) on the dynamics of White Crappie populations. Annual survey data and associated age data were used to estimate relative abundance, recruitment, individual growth rates, and total annual mortality rates of each White Crappie population. The relationships between system characteristics, fish abundance variables, and White Crappie population dynamics were assessed using principal component analysis and multiple linear regression. White Crappie were sampled from 32 impoundments and age was estimated for a subsample of 3,851 individuals. In general, White Crappie population dynamics were related to a variety of abiotic and biotic characteristics that largely reflected the influence of density-dependent processes. Surface area served as a surrogate for many of the covariates considered and may be useful in guiding management of White Crappie populations. Specifically, large impoundments with high predator abundance will likely support robust crappie fisheries due to density-related improvements in growth. Conversely, impoundments with small surface areas tended to have high densities of crappies and other centrarchid competitors, which resulted in slow growth rates and potentially poor-quality crappie fisheries. Overall, our results highlight the value of dynamics rate functions for understanding the mechanisms underlying White Crappie populations which can be used to improve management of the species.

Article in review

Evaluation of protected slot limits for Bluegill
Ben Neely

Bluegill in Kansas impoundments are largely unregulated but support a variety of fisheries. In instances where trophy angling desired, more stringent regulation may be warranted to shift size structures to larger fish. Kansas Department of Wildlife, Parks, and Tourism implemented a 6 to 9-inch protected slot length limit with an unlimited creel limit under the slot and five individuals above the slot at four fisheries and retained no regulation on four control fisheries. Initial findings suggest some populations may have been altered while others were not. Size structure, relative abundance, and growth will be formally compared between regulated and unregulated populations using a BACI design upon completion of data collection.

Project in progress

Evaluation of sampling methods for sunfish *Lepomis* ssp. and Largemouth Bass *Micropterus salmoides* in small Kansas impoundments

Brendon Tran, Jim Miazga, and Ben Neely

Bluegill *Lepomis macrochirus* and Redear Sunfish *Lepomis microlophus*, hereafter, referred to as sunfish, support important sport fisheries in small impoundments throughout Kansas. Typically, sunfish populations are surveyed with trap nets in the fall. However, fall trap nets may not accurately represent population size structure and abundance. Therefore, we sought to better understand sunfish populations by comparing population size structure and abundance between various sampling methods. Sunfish populations were sampled from five small impoundments in October 2022 with trap nets and electrofishing surveys were conducted in May 2023. Kolmogorov–Smirnov tests and cumulative length frequency distribution plots were used to identify differences in size distribution between sampling methods. Differences in relative abundance were examined using muti-gear mean standardization and coefficient of variation. Our results indicated a significant difference in the size distribution of sunfish populations when sampled with fall trap nets and spring electrofishing. Furthermore, abundance of sunfish in trap nets was more variable compared to more consistent abundance when surveyed with spring electrofishing. Spring electrofishing can provide more precise abundance estimates of harvestable sized sunfish, whereas fall trap nets provide an index of recruitment. Overall, use of both sampling techniques can improve management of sunfish populations, with minimal additional effort.

Poster presentation at Kansas Natural Resources Conference

Smallmouth Bass Stocking Evaluation in Small Kansas Impoundments

Ernesto Flores, Jeff Koch, Ben Neely

In Kansas, Largemouth Bass are the number one most preferred species by anglers, whereas Smallmouth Bass ranked as the seventh most preferred species. Discrepancy between the rankings could be attributed to the lack of angling opportunities for Smallmouth Bass. Largemouth Bass have been widely stocked in Kansas waters, whereas Smallmouth Bass stocking has been intermittent and at low levels. Well established Smallmouth Bass populations typically occur in large, USACE reservoirs. In 2023, 573 Smallmouth Bass were sampled statewide, most of which (92%) were sampled in larger impoundments (> 1,000 surface acres). Stockings appears to improve catch rates of Smallmouth Bass in large reservoirs in subsequent years, but formal evaluations have been limited. Although, Smallmouth Bass populations have been established in small impoundment (< 500 acres), these populations display low relative abundance and stocking occurs infrequently. Large-scale stocking evaluations in large reservoirs may be difficult. Additionally, availability of Smallmouth Bass fingerlings is low, which may curtail stocking numbers required to adequately supplement multiple large reservoirs. Stocking Smallmouth Bass in small impoundments would require fewer fish stocked and allow for thorough evaluation with less effort. Habitat characteristics in some small impoundments appear suitable (rocky jetties, clear water, abundant forage) for Smallmouth Bass and anglers spend a relatively equal amount of time fish reservoirs (6.10 days/yr.) compared to State Fishing Lakes (5.36 days/yr.). Small state fishing lakes may provide a good study area to evaluate Smallmouth Bass stocking rates, while also creating additional fishing opportunities. With an up-and-coming

Smallmouth Bass broodstock, KDWP will more thoroughly evaluate stockings in large reservoirs while also monitoring population development in state fishing lakes beginning in 2024.

Kansas Department of Wildlife and Parks Centrarchid Hatchery Production in 2023

Species	Size	Quantity
Largemouth Bass	Fingerlings	161,650
	Early-spawn fingerlings	82,500
	Adults	720
Bluegill	Fingerlings	126,555
	Adults	3,030
Bluegill x Green Sunfish	Adults	4,525
Black Crappie	Fingerlings	54,000
Smallmouth Bass	Fingerlings	4,000

Michigan Centrarchid 2023 Summary- Matt Diana

Centrarchid Committee

Michigan DNR has decided to combine Largemouth and Smallmouth Bass management and Panfish to form a Centrarchid Committee. The committee will have separate subsections for black bass and sunfish. The goal of the committee is to develop a sunfish management plan for the state of Michigan and further develop sunfish management options for the state. Terms of Reference are being drafted and membership is being solicited. The inaugural meeting is planned for late winter.

Dam Removal

Michigan DNR has focused efforts on dam removal for DNR, municipal, and privately owned dams. Several dam removals have been completed and are ongoing on the Kalamazoo River as part of Superfund cleanup activities. Three dams have been removed and three more are in planning. DNR and Western Michigan University have been conducting research on changes in fish communities as a result of removing dams. The primary sportfish in the Kalamazoo River is Smallmouth Bass and research has focused on diet shifts and movement patterns as these populations improve following river restoration. The purpose of the project is to determine if remediation goals result in desired restoration. Initial finding show shifts in Smallmouth Bass abundance as reservoirs return to lotic conditions, but some species are slower to respond. Floodplain connection and in stream habitat are limiting factors being evaluated.

Tournament Registration System

The Michigan DNR continues to require tournament registration for all Largemouth Bass fishing tournaments. The data registration system and reports are available here: https://www.mcgi.state.mi.us/fishingtournaments/. Data collected through this process is used to evaluate tournament pressure on individual lakes as well as compile statewide data. Research has focused on relating tournament pressure to Largemouth Bass population dynamics.

Emerging Diseases

Largemouth Bass virus has been detected in more waters including Great Lakes populations. The virus has also been detected in Smallmouth Bass. Michigan State University has been researching the prevalence and spread of the disease and how it is correlated to fish kills.

Aquatic Nuisance Control

Chemical treatment of vegetation has been a concern for DNR fisheries managers. In Michigan, vegetation control is conducted privately often by Lake Associations or Townships. DNR biologists have little input to the regulatory process and regulation is not very restrictive. Fish habitat and health is impacted by many of the practices conducted on lakes with residential shorelines. DNR and EGLE have formed a workgroup to evaluate potential conflicts between vegetation and fisheries management. One recent change that came out of the workgroup was to restrict copper use during May through June to protect spawning fish. Copper is an irritant that can drive fish off the nest and can have lethal impacts to eggs and invertebrates. The committee has begun evaluating Centrarchid populations in lakes with varying chemical treatment histories to determine if patterns in abundance and size structure are evident. This is a complicated process as the treatment history is not documented in a way that facilitates large scale analysis. Efforts have focused on developing a database of chemical treatment history that can be used in conjunction with DNR fish data to evaluate potential population level effects.

Minnesota Centrarchid 2023 Summary- Ryan Carrow

Projects:

- Tournament conflicts and looking at our tournament rules.
- Bass aging and attempting to understand population dynamics.
- Exploring expansion of catch and release bass season.
- Review of EF both as an effective index of relative abundance and generally our capacity to standardize the technique.

Minnesota Panfish Tech Committee Update

Quality Sunfish Initiative: We continue to add lakes to the roster of reduced bag limits (5 or 10 daily) albeit at a much slower pace that the initial rollout. The program continues to be very popular among anglers.

Crappie: Researchers Chris Smith and Jeff Reed are in the project development phase of a study that will examine crappie population dynamics across a wide geographic area of the State. Previous work had been limited to lakes in west-central MN and was done 25 years ago. This work will be used to evaluate our current Toolbox Regulations (current options include a 5 fish daily bag limit, and a 5 fish daily bag limit with a 10-inch minimum size restriction).

Technology: We have been hearing a number of concerns related to the use of advance technology, particularly by ice anglers. The Section of Fisheries has convened a workgroup consisting of biologists/managers and avid anglers to discuss the ramifications of technology use and provide guidance to anglers on angling best practices related to that use.

Barotrauma: We have heard from stakeholders for several years that fall and winter angling for crappies in deep basins was resulting in release mortality from barotrauma. We're currently doing a series of experiments related to barotrauma (see Will French's talk at this meeting) and will have results forthcoming.

There are several panfish-related papers from MN at the Midwest this year. Please check them out!

Jon Hansen – MN QSI

Chris Uphoff – Bluegill sex ratios

Chris Smith – Black Crappie/Bass/Pumpkinseed sex ratios (CANCELLED)

Bethany Bethke – Yellow Perch Dynamics

Beth Holbrook – Yellow Perch Population Structure/sampling (CANCELLED)

Will French – Black Crappie Barotrauma

Nick Rydell – Panfish Angler Use of Technology

Nebraska Centrarchid 2023 Summary- Sean Farrier

Comparing Bluegill Growth Among Newly Constructed, Renovated, and Established Flood-Control Reservoirs in Southeastern Nebraska

Matthew Perrion, Jacob Werner, Jehnsen Lebsock, Brett Miller, and Aaron Blank

Multiple reservoirs have been constructed in the last ten years in southeastern Nebraska for flood-control and recreational purposes. In addition, other existing reservoirs have undergone major renovations in the same time period to remove sediment and aquatic invasive species. This situation created the opportunity to compare bluegill (*Lepomis macrochirus*) growth between

newly constructed, renovated, and established reservoirs. This study analyzed bluegill growth data from eight different flood-control reservoirs in southeastern Nebraska in 2021 and 2022. The study objectives were to (1) determine aging precision of scales and otoliths in bluegill and (2) evaluate bluegill growth among new, renovated, and established flood-control reservoirs. For all bluegill collected during the study, exact percent agreement for otolith ages between two readers was 89.6%, and percent agreement was 99.1% within one year of age. For scales, exact percent agreement was 48.0% and 84.3% within one year. Mean length at age for all reservoir types were similar for age-2 bluegill, whereas age-3 bluegill had longer mean lengths in renovated reservoirs than either new or established reservoirs. Mean lengths of age-4 bluegill from new and renovated reservoirs were similar, but greater than mean lengths of age-4 bluegill in established reservoirs. Results of this study further demonstrate the greater precision of whole view otolith aging for bluegills compared to scale estimates and will benefit future managers to make management decisions for bluegills. Managers can also use information ascertained from bluegill growth metrics to further manage bluegill populations based on reservoir age and management objectives.
Article was accepted on 12/4/2023 to the Journal of Lake and Reservoir Management. The copyeditor is working through formatting and hopefully the journal will be in print by early 2024.

Evaluation of Black and White Crappie Populations in Medicine Creek Reservoir
Sean Farrier, Mark Staab, Jared Lorensen

As part of a multiyear study, we have been evaluating the black and white crappie population in Medicine Creek Reservoir. The purpose of this study is to determine if a more restrictive regulation is needed to provide a better fishery for anglers. Specifically, we are considering a 10-inch (250 mm) minimum size restriction to improve our size distribution at harvest. Age data from 2022 and 2023 showed white crappie are growing faster than black crappie. Mean total length at age-7 in 2022 was 295 mm and 248 mm for white and black crappie, respectively. The oldest fish observed in 2023 for white crappie was age-5 with a mean total length of 255 mm. The mean total length for black crappie at age-5 was 231 mm. We observed three black crappies that were age-8 in 2023 with a mean total length of 249 mm. This project will continue in 2024 and should provide valuable information for crappie management at Medicine Creek Reservoir.

Changes to Bluegill Harvest Regulations in Several Sandhill Lakes
Joe Rydell and Zac Brashears

A new regulation went into effect on January 1st, 2024, at Smith Lake WMA, Smith Lake FWS, Island Lake, Blue Lake, Frye Lake, Duck Lake, and Pelican Lake in the sandhills of northwest Nebraska. The regulation restricts harvest to only one fish over 9 inches (228 mm) as part of the statewide aggregate daily bag of 15 fish. Past age data showed it takes 8-10 years for a bluegill to reach 9 inches in these lakes. With this new restrictive regulation, the goal is to protect some of those older fish and shift harvest focus on smaller fish to help avoid overabundance.

Extensive Centrarchid Winterkill in 2023
Joe Rydell and Zac Brashears

Worth noting is the extensive winterkill observed in northwest Nebraska in 2023. Largemouth bass, bluegills, and black crappie were the species hit hardest in this event caused by above normal snowfall in the area. Several lakes were documented having complete kills of both largemouth bass and bluegills. Most impacted lakes were restocked by fall 2023 and populations will continue to be monitored closely in 2024.

Nebraska Game and Parks Commission Centrarchid Hatchery Production 2023

It was a busy year for Centrarchid production by our NGPC state hatcheries. In total, 4 of the 5 state fish hatcheries operated by NGPC contributed to Centrarchid production in 2023. The table below informs on the number of fish stocked statewide in 2023.

Taxa	Scientific Name	Number Stocked
Bluegill	*Lepomis macrochirus*	1,806,482
Bluegill X Green sunfish	*L. macrochirus* X *L. cyanellus*	14,950
Smallmouth Bass	*Micropterus dolomieu*	1,347
Largemouth Bass	*Micropterus salmoides*	339,360
White Crappie	*Pomoxis annularis*	30,307
Black Crappie	*Pomoxis nigromaculatus*	33,760
Total		**2,226,206**

Ohio Centrarchid 2023 Summary- Zak Slagle

Variability in and Relatedness of Ohio's Largemouth Bass populations

Rachael Finigan, Ph.D. Student at Ohio State University

The central objective of this project is to understand how largemouth bass populations differ across Ohio, what environmental characteristics are influencing this variation, and what mechanisms underlie this variation (e.g., phenotypic plasticity and natural selection). Early-life growth rate was found to be inversely correlated with population density and asymptotic length but was positively correlated with littoral habitat. Genetic analyses found that Largemouth Bass populations display weak patterning across Ohio waters from Lake Erie to the Ohio River. A common garden experiment on early life history has had limited spawning success; some evidence was found for differences between two lake populations, but low sample size has limited conclusions so far.

Summary of Ohio's Lotic Black Bass Populations

Taylor Hunkins, Fisheries Biologist, Ohio Division of Wildlife

The Ohio Division of Wildlife samples stream black bass populations annually during July–September using boat electrofishing; recently, these data were summarized to assist anglers in exploiting this underutilized fishery. The ODNR-DOW electrofished 23 streams for black basses during 2017–2022 and collected a total of 2,609 Smallmouth Bass, 577 Largemouth Bass, and 734 Spotted Bass. Information from this statewide sampling program provides ODNR-DOW inland fisheries managers with a better understanding of the quality of stream black bass populations in Ohio. Further, this information will be useful to inform anglers of fishing opportunities in Ohio streams and rivers.

Spatial Ecology of Lake Erie's Smallmouth Bass Lake and Tributary Populations

Zak Slagle, Fisheries Biologist, Ohio Division of Wildlife

The Ohio Division of Wildlife is currently conducting two distinct acoustic telemetry projects on Lake Erie's Smallmouth Bass (SMB) populations. The first is an Ohio Sea Grant-funded study of main Lake Erie population movements. Sixty SMB were tagged in the Western and Central basins in spring of 2023 with ~150 additional tags planned for 2024. Study objectives including learning about population segregation, seasonal range changes, and movement rates for angling-caught and electrofished individuals. The second project is funded by the Great Lakes Fishery Commission and is a collaboration with USGS-Wisconsin Co-op/UW-Stevens Point, UW-Milwaukee, and Wisconsin DNR. Sixty SMB were tagged in two of Lake Erie's tributaries during spring of 2023, with additional fish tagged in tributaries and bays of Green Bay in Lake Michigan. Researchers hope to identify migratory vs nonmigratory river stocks and study site fidelity and dispersal. Tagged fish will be tracked through the Great Lakes Acoustic Telemetry Observation System (GLATOS). Genetic samples from both projects will be analyzed to determine whether genetic and telemetry inferences align.

Wisconsin Centrarchid 2023 Summary- Zach Feiner

WDNR Panfish Team Update

Submitted by Alex Latzka (WDNR) Zach Feiner (WDNR, UW-Madison Center for Limnology; zachary.feiner@wisconsin.gov), and Dan Dembkowski (USGS Wisconsin Cooperative Fishery Research Unit, UW-Stevens Point)

Experimental Regulations Project

The Wisconsin DNR Panfish Team has been preparing for the first evaluation at the halfway point of our statewide 10-year experimental panfish (including sunfish and yellow perch) regulations. This project implemented new restrictive regulations (1. 25-bag with no more than 10 of any species, 2. 15-bag with no more than 5 of any species during May and June, and 25-bag the rest of the year, and 3. 15-bag with no more than 5 of any species) on a total of approximately 100 lakes across the state, and we have been conducting spring fyke netting and electrofishing to track changes in bluegill, black crappie, and yellow perch density and size structure. In 2023-2024, we will analyze these data and conduct accompanying angler surveys. Initial analyses suggest that the most restrictive regulation (5/15) did increase bluegill and black crappie size structure, while being generally supported by anglers and other stakeholders. WDNR is currently examining whether to add a 5-bag regulation to their panfish management toolbox. In addition to the analyses of experimental regulations, our next projects include developing metrics to characterize panfish populations with stunted or over-harvested size structures that are and resilient or vulnerable to high harvest. Panfish Team will also be collaborating with a CASC-funded project at UW-Madison and UW-Stevens Point to understand climate change impacts on bluegill fisheries and angler responses to future panfish fisheries changes, the first parts of which are described below (contributions from Stankowski et al. and Kerkhove et al.).

Use of remote car counters to evaluate potential shifts in angler effort in response to implementation of more restrictive panfish regulations

Submitted by Dan Dembkowski (UWSP)

As part of the Wisconsin Department of Natural Resources Adaptive Management Project for Panfish (AMPP), a series of more restrictive panfish regulations consisting of 25/10 (25 total, ≤ 10 of any one species), 15/5 (15 total, ≤ 5 of any one species), and seasonal 15/5 (15 total, ≤ 5 of any one species during May and June; 25 fish in aggregate otherwise) were implemented in 2016 at lakes meeting criteria for experimental regulations with the intent of increasing panfish size structure. As part of the AMPP, the Wisconsin Cooperative Fishery Research Unit at UW-Stevens Point (in collaboration with WDNR Panfish Team) used car counters to assess potential shifts in angler effort in response to implementation of more restrictive panfish regulations. Car counters were deployed at a subset of lakes within each regulation group during 2015 and 2016 (pre-regulation) and 2021 and 2022 (post-regulation) to determine if angler behavior changed in response to regulation implementation. Trail cameras were deployed at half of the lakes with car counters during 2015 to evaluate the efficacy of car counters for monitoring angler effort. Results suggest that car counters can be used to monitor angler effort in some water bodies. Car counter-derived estimates of angler effort were variable among regulation groups and between time periods and the distribution of effort among regulation groups changed between pre- and post-regulation time periods but we did not observe any systematic trends that would suggest broad-scale shifts in effort away from lakes with more restrictive harvest regulations and toward lakes with greater opportunities for harvest. Project led by Dan Dembkowski, who will present findings at the Midwest meeting. Manuscript in draft.

Bluegill growth and size structure in the Midwestern USA: Predictive models and benchmarks for fisheries management

Submitted by Dakota Stankowski (Wisconsin Cooperative Fishery Unit, University of Wisconsin-Stevens Point; dstankow@uwsp.edu), Daniel Isermann (USGS-Wisconsin Cooperative Fishery Unit, University of Wisconsin-Stevens Point)

In the upper Midwest, ongoing climate change may have significant effects on the dynamics and demographics of bluegill populations. Changes in bluegill populations will likely translate to changes in bluegill fishing opportunities and angler utilization of these fisheries, leading to potential changes in management philosophies and strategies. The objectives of this study are to determine if a suite of abiotic and biotic factors explain spatial variation in bluegill growth and size structure across the Midwestern USA and while also providing fishery managers within the region with standards for categorizing bluegill populations based on growth and size structure. Data analysis is ongoing and initial results were presented at the Midwest Fish and Wildlife Meeting in 2023. Latitudinal and longitudinal gradients were significant factors explaining variation in bluegill growth, while abundances of predators and competitors (e.g., northern pike, black crappie) were secondarily important. A manuscript is currently being prepared. In addition, we are developing a region-wide bluegill assessment tool that will allow managers to contextualize the abundance, growth, and size structure of their lake(s) of interest with regional- and state-specific benchmarks. This tool will be released in 2024.

Impacts of technology on angler catch rates and satisfaction for bluegill across the state of Wisconsin

Submitted by Amanda Kerkhove (UW-Madison Center for Limnology), Ashley Trudeau (UW-Madison Center for Limnology), Olaf Jensen (UW-Madison Center for Limnology), Dan Isermann (USGS Wisconsin Cooperative Fishery Unit, UW-Stevens Point), and Zachary Feiner (UW-Madison Center for Limnology and WDNR; zachary.feiner@wisconsin.gov)

Technological advancements, such as GPS, sonar, and underwater cameras, have enabled anglers to be better equipped than ever before to locate, catch and harvest fish. In Wisconsin, these types of technology are prevalent among anglers targeting panfish, such as Bluegill (L. macrochirus), one of the most targeted species in the state. The objectives of this research were to understand demographic patterns of panfish anglers, assess the degree to which technology use impacts catch efficiency, and evaluate the effects of technology on angler satisfaction. We used creel surveys to analyze angler pre-trip catch rate expectations and their end of trip catch rates, as well as their satisfaction. Additionally, we collected demographic information about ice anglers in urban and rural areas of Wisconsin to better understand which populations of anglers utilize these technologies while fishing. Broadly, we found that the effects of technology on catch rates were minimal and varied among angler groups (shore, ice, or boat anglers). Expectations may have been increased by technology use, and satisfaction may decrease with technology use, but the overarching conclusion was that technology use had mild, if any, effects on panfish fisheries at the moment. This paper is currently in review in Fisheries (Kerkhove et al., in review).

Centrarchid population responses to intensive removal in a northern Wisconsin lake

Submitted by Dan Dembkowski (UWSP)

This project is associated with a large-scale centrarchid removal project conducted by the Wisconsin Cooperative Fishery Research Unit, Center for Limnology at UW-Madison, and Wisconsin Department of Natural Resources that occurred on McDermott Lake, Iron County during 2018-2021. Although the initial intent of the project was to determine walleye population responses to large-scale reductions in centrarchid densities, removals also offer a unique opportunity to assess responses of the remaining centrarchid populations. The objective of this study is to determine the effects of intensive removal on population dynamics and demographics of black crappie, bluegill, largemouth bass, and pumpkinseed relative to observations from an unmanipulated reference lake. A secondary objective is to assess the validity of otolith-based back-calculations for estimating previously observed mean lengths at age for specific cohorts of black crappie, bluegill, and largemouth bass. The first year of post-removal data was collected during 2022 and sampling will continue during 2023. This project is led by MS student Becca Henningsen at UWSP.

Largemouth and Smallmouth Bass

Coarse woody habitat addition influences on hyperstability in largemouth bass catch rates

Submitted by Camille Mosley (University of Notre Dame), Stuart Jones (University of Notre Dame), Chris Solomon (Cary Institute of Ecosystems Studies), Stephanie Shaw (WDNR), and Greg Sass (WDNR; gregory.sass@wisconsin.gov)

In partnership with Rainbo Lodge, Inc. (Land O' Lakes, WI) and the University of Notre Dame Environmental Research Center, research was initiated on Jones Lake in the summer of 2020 to test for coarse woody habitat addition influences on hyperstability in largemouth bass, bluegill, black crappie, yellow perch, and walleye catch rates. To investigate whether catch rate hyperstability varies amongst species or systems, we first tested whether electrofishing catch per unit effort (efCPUE) was an appropriate proxy for true abundance. We then compared the relationship between angler catch rate and fish abundance for common freshwater sport fishes across gradients of habitat availability. We found significant differences in the strength of hyperstability amongst species. We did not identify a consistent influence of habitat on hyperstability of catch rates. Angler preferences and behavior may explain some of the variance in non-proportional catch rates. Future research investigating angler behavior, population size structure, and population dynamics in these systems may identify key interactions that create differences in vulnerability to population collapse. This study was published in Fisheries Research (Mosley et al. 2022).

Mosley, C. L., Dassow, C. J., Caffarelli, J., Ross, A. J., Sass, G. G., Shaw, S. L., ... & Jones, S. E. (2022). Species differences, but not habitat, influence catch rate hyperstability across a recreational fishery landscape. Fisheries Research, 255, 106438.

Sport fish home range responses to a littoral coarse woody habitat addition in a north-temperate lake

Submitted by Quinnlan Smith (University of Minnesota-Duluth; smit7974@d.umn.edu), Greg Sass (WDNR), Thomas Hrabik (University of Minnesota-Duluth), Stephanie Shaw (WDNR), and Joshua Raabe (UW-Stevens Point)

Behavioural responses of fishes to littoral zone habitat enhancements are relatively understudied in diverse fish communities but are critical for understanding overall fish community responses. To advance knowledge on effects of coarse woody habitat (CWH) littoral zone enhancements, we initiated a long-term study on Sanford Lake, Vilas County, Wisconsin, where 160 trees were added to the littoral zone of

the lake in 2018. We tested for short-term home range responses in muskellunge (*Esox masquinongy*), smallmouth bass (*Micropterus dolomieu*) and walleye (*Sander vitreus*) to this CWH addition. We used radio telemetry data collected premanipulation (2017) and postmanipulation (2018 and 2019) to construct annual home range estimates for each species. Limited kernel density (LKD) estimates, which partially exclude terrestrial areas, were used for estimating 50% and 95% home ranges. Over the course of the three years, average home ranges for each study species increased suggesting a behavioural response to the CWH addition. Muskellunge had the greatest home range estimate increase, followed by smallmouth bass and then walleye. Muskellunge and smallmouth bass had similar home ranges, which were larger than walleye home ranges. Increased home ranges across species could be a searching or deviation from premanipulation equilibrium home range response as a result of the CWH serving as a prey fish refuge, which may make them relatively inaccessible to predators. Our results suggest that fish behavioural responses to CWH additions may be species-specific and should be taken into consideration prior to implementing littoral habitat enhancements in diverse fish communities.

Smith, Q. C., Sass, G. G., Hrabik, T. R., Shaw, S. L., & Raabe, J. K. (2022). Sport fish home range responses to a littoral coarse woody habitat addition in a north-temperate lake. Ecology of Freshwater Fish, 31(2), 454-468.

Fisheries Management

Climate change effects and RAD adaptation strategies in Wisconsin fisheries

Submitted by Zach Feiner (WDNR, UW-Madison Center for Limnology) on behalf of the WICCI Fisheries Working Group, https://wicci.wisc.edu/fisheries-working-group/

The Wisconsin Initiative on Climate Change Impacts (WICCI) Fisheries Working Group, which includes members from WDNR, GLIFWC, UW-Madison, and UW-Stevens Point, was recently tasked with surveying potential climate change issues and adaptation strategies for fisheries management as part of WICCI's update to their Climate Assessment Report (to be released in 2022). The working group developed a white paper (available on request, zachary.feiner@wisconsin.gov) in which one of the major climate impacts projected for Wisconsin fisheries are increases in warmwater species, particularly centrarchids like largemouth bass, bluegill, and black crappie. There is some evidence that increases in these species may provide new angling opportunities (Embke et al. 2020 found increasing harvest of these species in inland lakes) and somewhat buffer losses of popular coolwater species (Tingley et al. 2019 found maintaining quality bluegill fisheries limited the number of anglers who left a system when walleye fishing quality declined). We further examined current fisheries management practices in the state within the RAD (Resist-Accept-Direct) framework, and concluded that while most policies are resisting change, policies that can accept or direct new fishing opportunities for centrarchids will be needed in the future, likely requiring substantial investment in social-ecological strategies to prepare anglers to take advantage of emerging fisheries. This work was developed into a manuscript published in 2022 in to a special issue of Fisheries Management and Ecology focusing on the RAD framework (Feiner et al., 2022).

Feiner, Zachary S., Aaron D. Shultz, Greg G. Sass, Ashley Trudeau, Matthew G. Mitro, Colin J. Dassow, Alexander W. Latzka et al. "Resist-accept-direct (RAD) considerations for climate change adaptation in fisheries: The Wisconsin experience." Fisheries Management and Ecology 29, no. 4 (2022): 346-363.

Largemouth bass-environment influences on walleye recruitment depensation in Wisconsin lakes

Submitted by Colin Dassow (WDNR; colin.dassow@wisconsin.gov), Greg Sass (WDNR), Stephanie Shaw (WDNR), and Zach Feiner (WDNR, UW-Madison Center for Limnology)

Recruitment depensation threatens exploited fish populations because as harvesting and/or other factors (e.g., climate change, invasive species) reduce adult stock size, populations can become trapped in a positive feedback loop where declining abundance leads to declining recruitment and further abundance declines. Using estimates of depensatory recruitment dynamics from 28 walleye (*Sander vitreus*) populations in Wisconsin identified by Sass et al. (2021, *Fisheries*), we tested for potential abiotic and biotic predictors of walleye recruitment depensation. The best fitting model contained covariates for climate, land use, and fish community composition, all interacting with largemouth bass (*Micropterus salmoides*) relative abundance to explain variation in depensation. The consistent interaction effect of largemouth bass relative abundance across the other covariates suggests a key role this competitor species plays in walleye recruitment at low stock sizes. Specifically, as largemouth bass became more abundant, the risk of depensatory recruitment increased. Using this model, the vulnerability to depensation was predicted using our best fitting model and 117 walleye lakes with insufficient data to estimate the risk of depensation directly. Predictions suggested that many walleye lakes considered would be vulnerable to depensatory recruitment should stock sizes decrease significantly. Using these predictions of vulnerability to depensation, we discuss how managers might prioritize lakes using their risk of depensation. Identifying lakes which already have low adult walleye abundances and a high risk of depensatory recruitment as systems where committing limited stocking resources may not be an efficient use of these limited resources.

Dassow, C., Sass, G., Shaw, S., Feiner, Z., Nieman, C., & Jones, S. (2023). Depensation in fish recruitment driven by context-dependent interactions with another predator. Fisheries Research, 262, 106675.

Black crappie influences on walleye natural recruitment in northern Wisconsin lakes

Submitted by Steven Broda (WDNR), Zach Feiner (WDNR, UW-Madison Center for Limnology), Stephanie Shaw (WDNR), and Greg Sass (WDNR; gregory.sass@wisconsin.gov)

Natural recruitment has declined in northern Wisconsin Walleye *Sander vitreus* populations over time. Several factors have been implicated to explain Walleye natural recruitment declines including climate change, increased centrarchid abundances, imbalances in fish communities, production overharvest, species-specific voluntary release by anglers, and cultivation/depensation effects. Empirical evidence has shown that White Crappie *Pomoxis annularis* and Walleye negatively interact, whereas anecdotal evidence between Walleye and Black Crappie *P. nigromaculatus* suggests a similar, negative interaction. We used all available Wisconsin DNR total Black Crappie and age-0 Walleye relative abundance data collected during 1991- 2017 to test for: 1) trends in age-0 Walleye and total Black Crappie relative abundance over time; 2) a relationship between age-0 Walleye and total Black Crappie relative abundance; 3) patterns in age-0 Walleye and total Black Crappie relative abundances in a subset of lakes with longer-term data for both species over time; and 4) the influence of several abiotic and biotic covariates (including Black Crappie relative abundance on age-0 Walleye recruitment). Age-0 Walleye relative abundance significantly decreased over time, whereas total Black Crappie relative abundance significantly increased. The relationship between age-0 Walleye and total Black Crappie relative abundance showed a strong, threshold effect such that age-0 Walleye relative abundance was always low when total Black Crappie relative abundance was high. In a subset of lakes with longer-term data, most lakes showed reciprocal relationships between age-0 Walleye and total Black Crappie relative abundances. Among numerous abiotic and biotic factors tested to explain negative trends in Walleye recruitment, Black Crappie relative abundance was the only statistically significant predictor. This project was published in 2022 (Broda et al. 2022, NAJFM).

Broda, S. P., Feiner, Z. S., Mrnak, J. T., Shaw, S. L., & Sass, G. G. (2022). Black Crappie influences on Walleye natural recruitment in northern Wisconsin lakes. North American Journal of Fisheries Management, 42(5), 1202-1214.

Bass and walleye lakes with experimental regulations and stocking (BaWLERS) study

Submitted by Zach Feiner (UW-Madison Center for Limnology, WDNR, zachary.feiner@wisconsin.gov)

A project examining interactions between largemouth bass and walleye is ongoing. The goal is to liberalize largemouth bass regulations to reduce their abundance and determine whether this results in an increase in walleye recruitment. Largemouth bass minimum length limits were removed and stricter length limits for walleye were implemented on 7 lakes from 2007-2011 with an evaluation time period of 8 years, with regulations remaining the same on 11 reference lakes. Updates will be provided as they become available.

Seasonal variation in angler catch rates of Wisconsin anglers

Submitted by Greg Sass (WDNR), Zach Feiner (WDNR/UW-Madison; zachary.feiner@wisconsin.gov), and Sam LaMarche (WDNR)

Comparisons of angler catch and harvest rates among seasons with disparate modes of fishing, like open water and ice angling in north-temperate lakes, are lacking. We used all available Wisconsin Department of Natural Resources point-intercept creel survey data during 1990-2020 to test for seasonal differences in the fisheries for five species vulnerable to open water and ice angling in Wisconsin, USA, lakes (black crappie *Pomoxis nigromaculatus*, bluegill *Lepomis macrochirus*, northern pike *Esox lucius*, walleye *Sander vitreus*, yellow perch *Perca flavescens*). Specifically, we tested for: 1) species-specific differences in mean open water versus ice angling catch and harvest rates; 2) trends in species-specific mean open water versus ice angling catch and harvest rates during 1990-2020; and 3) monthly patterns in mean species-specific angler effort and catch rates. Mean angler catch rates of the five study species were significantly higher during the open water season and mostly temporally stable – only black crappie and bluegill open water catch rates and black crappie ice season catch rates significantly increased during 1990-2020. Mean angler harvest rates were significantly higher in the open water season for black crappie, bluegill, and walleye, but higher during the ice season for northern pike and did not differ between seasons for yellow perch. Harvest rates were mostly temporally stable across species, although harvest rates declined for bluegill ice fishing and yellow perch in both seasons. Species-specific angler effort and catch rates mostly corresponded with seasonal (spring/early summer) vulnerabilities of our study species, although higher winter effort and catch rate patterns for northern pike and yellow perch may suggest unique harvest preferences for those species. Our results suggest that ice angling should not be assumed to have a negligible influence on fish populations in north-temperate lakes, fisheries-dependent and -independent monitoring data should be jointly considered when assessing fish population status, research on the human dimensions of ice fisheries is critically needed, and angler knowledge of seasonal fish vulnerabilities are generally coupled with higher fish catch rates.

Sass, G. G., LaMarche, S. T., & Feiner, Z. S. (2023). Do angler catch and harvest rates differ between open water and ice anglers in Wisconsin?. Fisheries Research, 263, 106678.

Fish-Vegetation Relationships in Lakes

Submitted by Zach Feiner (WDNR, UW-Madison, zachary.feiner@wisconsin.gov)

A better understanding of the relationships between aquatic vegetation and fisheries could add important tools to the lake management toolbox to support fisheries goals. A multi-institution research team, funded Midwest Glacial Lakes Partnership, is conducting a study to assess relationships between plant community structure and fisheries outcomes across thousands of lakes in the Upper Midwest with the goal of developing guidance for holistic plant and fish management in lakes.

To identify pressing issues and develop hypotheses that will lead our analyses toward actionable outcomes, we are seeking expert opinion about relationships between aquatic vegetation and fish population performance. During this workshop, participants will 1) identify challenges of highest concern with respect to plant and fish management in lakes, 2) identify characteristics of aquatic communities most meaningful and relevant for management action, and 3) develop and prioritize hypothesized relationships between plant and fish communities that are relevant for practitioners. This input will be critical for ensuring our study provides a better understanding of fundamental ecological relationships between plants and fish, and helps identify lakes where habitat management