North Central Division American Fisheries Society

Centrarchid Technical Committee

2021 Annual Report

For the second consecutive year, the Centrarchid Technical Committee (CTC) did not have an in-person meeting to discuss topics. With continued travel restrictions and plans for the summer 2021 meeting to occur in Wisconsin, the Joint CTC/ETC/WTC meeting was cancelled. Plans for the summer 2022 meeting will be disseminated to the CTC state representatives following the 82nd Midwest Fish and Wildlife Conference in Des Moines, IA on February 13-16, 2022. Also, at that time, the chairmanship of the CTC will be passed to Will Radigan. Future communications can be directed to Will at the following email address: wradigan2@huskers.unl.edu.

Dakota

Lake Oahe Smallmouth Bass-Walleye interactions

Kyle Olivencia, a M.S. student at Iowa State University, is investigating interactions between smallmouth bass and walleye in Lakes Oahe and Sharpe. On Lake Oahe, research is focused on post-stocking predation of age-0 walleye by adult smallmouth bass and competition between adult walleye and adult smallmouth bass. On both Lakes Oahe and Sharpe, stable isotope analysis is being used to assess the trophic positions of adult walleye and smallmouth bass. Current findings are that on Lake Oahe, adult walleye and smallmouth bass' primary forage is lake herring, while on Lake Sharpe, gizzard shad are the primary forage for both species.

Western South Dakota Black Crappie Dynamics

Gene Galinat and Bill Miller, biologists out of the Rapid City SD GFP office, are comparing black crappie growth and other metrics in reservoirs that do and don't have shad. Black crappies are a popular sportfish in western South Dakota. We evaluated population characteristics including recruitment, growth, size structure and mortality in seven different prairie reservoirs. In addition, introductions of gizzard shad into western South Dakota reservoirs have been accomplished to provide a more consistent prey for sportfish. Negative effects gizzard shad can have on fish communities have been documented in literature, therefore, we also examined black crappie populations in reservoirs with and without gizzard shad and in reservoirs prior to and after gizzard shad introductions. We found black crappie populations in western S-outh Dakota are characterized by variable to moderately variable recruitment and generally experience some level of recruitment failure. The lakes with gizzard shad did show significantly ($t = 2.28$, $df = 10$, $P = 0.046$) improved growth rates and significantly ($\alpha < 0.05$) higher PSD-P values after the introductions. Black crappie abundance and mean condition did not show meaningful differences after the gizzard shad introductions occurred. The addition of gizzard shad did not appear to negatively affect black crappie populations in western South Dakota prairie impoundments but did correlate with improved sizes of fish and should be considered as a viable management option for creating quality crappie fisheries.

Northeast South Dakota Centrarchid Update

1) Hybrid Sunfish Angler Catches

Blackwell, B. G., M. J. Ward, and T. M. Kaufman. In Press. Evaluation of angler catchability of hybrid sunfish (male Bluegill x female Green Sunfish) for use in community fisheries. Aquaculture and Fisheries.

2) Northeast South Dakota Bluegill Exploitation

In 2021, fieldwork examining Bluegill exploitation in northeast South Dakota continued at Lake Enemy Swim and Pickerel Lake. Bluegills were collected with modified-fyke nets during May and June 2021 for tagging and mark-recapture population estimates. Bluegills (≥150 mm) were tagged ($100-reward tags and non-reward tags) at both lakes. Bluegill populations were also sampled as part of annual population surveys to examine various population parameters (e.g., relative abundance, size structure, condition, growth). In addition, a winter (December-March) creel survey was completed during the 2020-2021 winter and a summer (May-August) creel survey was completed during the 2021 summer at each lake.

Lake Enemy Swim

The 2021 population estimate at Lake Enemy Swim was nearly triple the 2020 estimate (Table 1). The increase in abundance is the result of recent recruitment. Three consecutive-strong year classes (ages 4-6) currently dominate the population. Bluegills at Lake Enemy Swim in 2021 were growing slower than the 2021 regional average. The mean length at capture for age-3 Bluegill was 98 mm (regional average = 154 mm), age-4 was 152 mm (regional average = 174 mm), age-5 was 177 mm (regional average = 189 mm), and 197 mm (regional average = 201) at age-6.

Anglers reported harvesting 12% (18) of the $100-reward Bluegills in 2021 (Table 2). The non-reward tag percent harvest (4%) is lower (Table 3).The 2021 summer creel survey estimated the Bluegill harvest at 6,972 fish (Table 4). This harvest estimate is 10.7% of the 2021 spring Bluegill population estimate. The exploitation estimates for $100-reward tags and the creel-harvest estimate are fairly close together helping to validate the two estimates.

Pickerel Lake

The 2021 Pickerel Lake population estimate showed a 58% reduction in Bluegill abundance over the 2020 estimate. The reduction in Bluegill abundance in 2021 aligns with the 49% exploitation estimate for $100-reward tags in 2020 (Table 2). Bluegill recruitment at Pickerel Lake is sporadic, the 2016 and 2017 cohorts comprised the majority of Bluegills in the population in 2020. In 2021, the 2018 cohort was the most abundant, but at a much lower level than the 2016 and 2017 cohorts in 2020. Pickerel Lake Bluegills are growing at a faster rate than those in Lake Enemy Swim. Mean lengths at capture were 173 mm at age-3, 198 mm at age-4, and 228 mm at age-5.

In 2021, anglers harvested 27% of the $100-reward tagged Bluegills tagged in 2021 (Table 2). The harvest estimate (7%) from non-reward tags was much lower (Table 3). The 2021 summer creel survey estimated the Bluegill harvest at 438 fish (5.5% of the population estimate; Table 4).

The monthly harvest distribution of the 2021 reward-tagged Bluegill harvest shows 11 fish (11% exploitation) were harvested during May-August, which is closer to the 5.5% harvest indicated by the creel estimate. Anglers reported harvesting 13% of the $100-reward fish during September after the 2021 summer creel survey had ended.

Table 1. Bluegill (≥150 mm) spring population estimates (95% CI in parentheses) for Lake Enemy Swim (2019-2021) and Pickerel Lake (2020-2021), South Dakota.

	Population estimate		
Lake	2019	2020	2021
Enemy Swim	18,152 (16,016-20,945)	21,989 (18,720-26,641)	65,442 (59,025-73,425)
Pickerel		19,066 (14,991-26,182)	7,925 (6,205-10,964)

Table 2. Bluegill (≥150 mm) tagging year, number of $100-reward tags each year, and the number of tags reported as harvested by anglers from each tag cohort by year and combined at Lake Enemy Swim and Pickerel Lake, South Dakota.

			Number reported harvested			
Lake	Tag year	$100 tags	1999	2000	2021	Combined
Enemy Swim	2019	149	9	10	3	21
	2020	150		45	14	59
	2021	150			18	18
Pickerel	2020	100		49	13	62
	2021	100			27	27

Table 3. Bluegill (≥150 mm) tagging year, number of non-reward tags each year, and the number of tags reported as harvested by anglers from each tag cohort by year and combined at Lake Enemy Swim and Pickerel Lake, South Dakota.

			Number reported harvested			
Lake	Tag year	# tags	1999	2000	2021	Combined
Enemy Swim	2019	850	30	30	2	62
	2020	849		117	36	153
	2021	873			38	38
Pickerel	2020	900		162	75	237
	2021	737			52	52

Table 4. Estimated angling pressure, number of Bluegills caught, and number of Bluegills harvested during summer (May-August) and winter (December-March) creel surveys completed at Lake Enemy Swim and Pickerel Lake, South Dakota (80% CI ± value in parentheses).

Lake	Period	Year	Pressure (hr)	Bluegill Catch	Bluegill Harvest
Enemy Swim	Summer	2019	17,960 (4,589)	2,112 (497)	795 (78)
	Summer	2020	COVID no survey		
	Summer	2021	21,980 (3,011)	19,721 (4,933)	6,972 (1,769)
	Winter	2019-2020	9,697 (3,301)	12,812 (4,212)	1,275 (414)
	Winter	2020-2021	10,108 (1,797)	22,895 (8,989)	4,594 (1,187)
Pickerel	Summer	2020	COVID no survey		
	Summer	2021	19,555 (3,686)	438	438
	Winter	2019-2020	21,226 (2,873)	14,869 (7,338)	1,623 (111)
	Winter	2020-2021	14,866 (1,921)	10,618 (2,374)	696 (292)

Iowa

- No report

Illinois

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

Nerissa McClelland, Illinois Department of Natural Resources

The Illinois State Hatchery System stocked approximately 50,100 black crappie averaging 3" into the Starved Rock Pool and approximately 80,000 smallmouth bass ranging in size from 1-1.5" into the upper Peoria, Starved Rock and Marseilles pools of the Illinois River in 2021.

University Research:

Amber Blackert, Illinois River Biological Station, Illinois Natural History Survey

Drivers of Fish Growth and Recruitment of Largemouth Bass, Bluegill, and Black Crappie at the Emiquon Preserve

Amber Blackert, Levi Solomon, Jason DeBoer, and James Lamer

This is the second year working on my graduate project on the Emiquon preserve which is a restored backwater lake that is managed by a water manipulation at a gated pumping structure with variable connectivity to the Illinois River. Trends in composition and structure of the

Emiquon fish community has been evaluated through standardized monitoring since initial stocking in 2007. The objectives of my graduate study project will determine the influence of biotic and abiotic predictors (water elevation, water temperature, vegetation abundance, plankton abundance) on 1.) year class strength using catch curve residuals, 2.) yearly growth using otolith increment width and biochronology, and 3.) growth (individual yearly and cohort specific using length at age and size structure), from largemouth bass, bluegill, and black crappie. Otolith collection for this project wrapped up in Spring 2021, all otoliths collected from sampling have been processed. Analysis is continuing, and results will be coming in 2022.

Eric Hine, Great Rivers Field Station, Illinois Natural History Survey

Hine, E.C., Colombo, R.E., Meiners, S.J., Moody-Carpenter, C.J. and Maia, A. (2021), An Assessment of Nighttime Electrofishing in the Lower Wabash River. North Am J Fish Manage. https://doi-org.proxy2.library.illinois.edu/10.1002/nafm.10710

Abstract: Large rivers are highly important systems that require close monitoring of the ecological consequences of factors like commercial and recreational exploitation, channel alterations, and climate change. The Long-Term Survey and Assessment of Large River Fishes in Illinois (LTEF) monitors the fish communities of the Illinois, Mississippi, Wabash, and Ohio rivers using daytime, pulsed-DC electrofishing between June and October each year. Previous research has documented diel differences in the catch and composition of fish communities. Therefore, the addition of nighttime electrofishing may be beneficial to the overarching goals of long-term monitoring. This study sought to determine whether there are significant diel differences in fish catch and composition in the Wabash River and whether these potential differences warrant the addition of nighttime sampling to the current protocol. We used nighttime, pulsed-DC electrofishing at fixed sites corresponding to LTEF sites in the lower Wabash River from June 7 to November 7, 2017. We compared catch per unit effort (CPUE), length distributions, family, and species composition between our nighttime electrofishing data and LTEF daytime electrofishing data. Nonmetric multidimensional scaling showed that the differences between nighttime and daytime electrofishing samples were driven by higher catches of catostomids, centrarchids, and lepisosteids. Nighttime electrofishing had significantly higher mean CPUE than daytime electrofishing, and the four families with significant differences were Catostomidae, Cyprinidae, Lepisosteidae, and Sciaenidae. Of the families for which we compared length data, only Sciaenidae had a significantly different length distribution, with a higher proportional catch of smaller individuals (<100 mm) at night. Despite these differences, compositional shifts were minor, with overlap between daytime and nighttime sampling. Due to the compositional similarities between night and day, the costs of adding nighttime electrofishing to long-term monitoring would not be necessary. We would recommend nighttime electrofishing for targeting specific taxa and age-classes that are underrepresented in daytime samples.

Dr. Joe Parkos, Kaskaskia, Ridge Lake, and Sam Parr Biological Stations, Illinois Natural History Survey

In 2021, Parkos lab at Kaskaskia (KBS) and Sam Parr (SPBS) Biological Stations (Illinois Natural History Survey) continued sampling and analysis of a multiple-reservoir experiment

testing the efficacy of harvest regulations for improving crappie and bluegill size structure. This experiment includes the collection of biological and creel survey data from unmanipulated reference reservoirs and reservoirs with experimental harvest regulations. The KBS and SPBS group also conducted research on questions related to habitat enhancements, including a whole-lake addition of coarse woody habitat, the addition of artificial cubes to individual coves in a large reservoir, and the effects of habitat enhancements on sport fish populations and angling quality in urban lakes. To date, results have shown that centrarchids, particularly *Lepomis* and *Pomoxis* species, have the strongest response to increased availability of structurally complex habitat.

Joe Rector, Southern Illinois University

Though demographics and vital rates of black crappie and white crappie populations in lakes and reservoirs have historically been well researched, published information on crappie population dynamics in large river systems is deficient. Embayments at the confluences of tributaries and large rivers and their associated backwaters can serve as important low current, structure rich habitat for crappies, especially in systems like the Ohio River that lack extensive natural backwater areas due to a geologically constrained river valley and human modifications. As a result, crappie population densities are often much higher in tributary embayments than in the mainstem river. Combined with crappies' general popularity as a sportfish, relatively concentrated populations of tributary embayment crappie have led to these fish placing among the most sought-after species in the tributary rich Smithland Pool of the Ohio River. However, despite drawing the attention of many anglers, the requisite information to assess factors influencing crappie population dynamics, such as exploitation, mortality, growth, and recruitment in this system is limited. The objectives of this study are to estimate growth and mortality rates using aged otoliths and length data for crappies sampled from the Ohio River and tributary mouths during 2020 and 2021. Records of crappie captures from Ohio River tributary fish community data collected by the Illinois Department of Natural Resources from 1995 to 2021 will be used to assess patterns of year-class strength and model relationships between recruitment and environmental variables. Results of this study will provide baseline information useful for management of black and white crappie populations in large river-tributary systems.

Kyle Rempe, Easter Illinois University, Integrative Physiology Lab

In an effort to better understand the whole organismal effects that unnatural thermal regimes place on ectotherms, the growth and physiology of Centrarchids taken from Coffeen Lake were compared to one another. Black Crappie were thought to be the more thermosensitive species when compared with Bluegill, and we hypothesized that this should be evident when comparing their bioenergetics data to one another. The reservoir, which stopped receiving warm effluent release in October 2019, was sampled using DC boat electrofishing for Black Crappie and Bluegill during the fall 2019, spring 2020, and fall 2020 seasons. Modified fyke nets were also used during fall 2019 efforts. Fishes were taken from the lake and processed at Eastern Illinois University for sagittal otolith extraction, with some individuals also kept alive in tanks for further mitochondrial work examining cellular respiration.

Our findings for Black Crappie in Coffeen Lake show PSS-Q and PSS-P values of 58 and 42 respectively for the combined fall 2019/fall 2020 electrofishing data, suggesting a balanced population. However, there was also a high total annual mortality occurring (0.606), possibly due to Black Crappie reaching harvestable sizes that could be desirable by anglers. Mitochondrial data for them also suggests that Black Crappie operate their Electron Transport System (ETS) in a more efficient manner when it comes to Adenosine Triphosphate (ATP) production and show increased activity in the more thermosensitive complex, Complex I, when compared with Bluegill.

In comparison, the PSS-Q and PSS-P values for Bluegill sampled via DC electrofishing for spring 2020 data were 3 and 0.6 respectively, and the PSS-Q and PSS-P values for Bluegill sampled via DC electrofishing for the combined fall 2019/fall 2020 data were 1 and 0 respectively. In addition to having an abundance of stock size individuals, seasonal mean length at age graphs for them also showed irregular, almost linear, growth occurring which has been documented in the Coffeen Lake Bluegill population before. Bluegill also displayed high total annual mortality values (0.774 for spring 2020 DC electrofishing data, 0.732 for combined fall 2019/fall 2020 DC electrofishing data) which we believe could possibly be explained by their observed bioenergetic drawbacks. Bluegill had more proton leakage (LEAK) occuring in their ETS, meaning they also displayed less efficiency in their ATP production. Although Bluegill were less ETS limited when compared to Black Crappie and more capable of operating in supraoptimal temperatures, we hypothesized that the tradeoffs for this came in the form of unnatural organismal growth and less efficient energy production.

Jeremy Tiemann, University of Illinois Urbana-Champaign, Illinois Natural History Survey
Trent Tomas, Illinois Department of Natural Resources

In 2021, we monitored our brood source location, Fish Creek (Sangamon River drainage, Illinois), for Redspotted Sunfish (*Lepomis miniatus*). We found 13 individuals, which is slightly above average and indicates that the brood stock population appears to still be doing fine. From 2008-2010 Redspotted Sunfish were collected from Fish Creek and used ask brood stock in research ponds. Subsequent juveniles were used to stock eight sites across central Illinois. Two successful locations included Fish Preserve Lake at Emiquon Nature Preserve in Fulton County, Illinois and Mansion Pond at Allerton Park in Piatt County, Illinois.

For more information:

- https://www.inhs.illinois.edu/research/biosurveys/projects/redspotted-sunfish
- http://www.nanfa.org/ac/AC2014vol39no4_tiemann_redspotted-sunfish.pdf
- https://blogs.illinois.edu/view/7362/809209
- https://www2.illinois.gov/dnr/conservation/IWAP/Documents/SWGReports/T-58%20D-1%20Redspotted%20Sunfish%20FY%202007-9%20State%20Wildlife%20Grant%20-%20Final%20Report.pdf
- https://www.researchgate.net/publication/275969129_Distribution_and_status_of_the_state-endangered_Redspotted_Sunfish_Lepomis_miniatus_in_Illinois

Andrya Whitten, Illinois River Biological Station, Illinois Natural History Survey

The Long-term Survey and Assessment of Large River Fishes in Illinoi (LTEF) collected its first record of Spotted Bass (*Micropterus punctulatus*) in the Peoria Pool of the Illinois River south of Chillicothe, Illinois (UTM Zone 15N, N/S4534494 E/W0795958). The Spotted Bass was 247 mm in total length and weighed 199 g and is being vouchered at the University of Illinois Champaign-Urbana Illinois Natural History Survey Museum. This is the first record of Spotted Bass in LTEF's 13 years (2009-2021) of current fixed and random site surveys using direct current (DC) electrofishing. Two records of Spotted Bass have been collected in the LTEF's historical fixed sites sampling using alternating current (AC) electrofishing (1957-2015; https://illinois-river-bio-station.inhs.illinois.edu/research/current-projects/ltef/). One Spotted Bass was collected from the La Grange Pool of the Illinois River in 2011 and five Spotted Bass were collected from the Dresden Island Pool of the Des Plains River in 2014 through historical LTEF (2014 samples will be verified and vouchered in 2022).

Indiana

- No report

Kansas

Crappie Exploitation Project

By: Danci Johnston, Seth Lundgren, and Dr. Quinton Phelps

Crappie (i.e., White Crappie and Black Crappie) exploitation rates were evaluated across three southeast Kansas reservoirs: Elk City Reservoir, Big Hill Reservoir, and Parsons City Lake. One-thousand crappie greater than 210 mm (8 inches) were tagged in each reservoir and monitored over a one year period. Reward tags were used to quantify harvest, movement (i.e., from location of tagging to location of catch), emigration, and angler demographics. Additional sampling was conducted on Parsons City Lake to develop a population estimate and further evaluate angler harvest and reporting rates. Reporting rates (and harvest rates?) varied between reservoirs; Elk City at 234 reported (19% harvested), Big Hill at 166 reported (14% harvested), and Parsons at 37 reported (3% harvested). Given the harvest rates across these reservoirs and the standing stock on Parson City Lake the current statewide regulations are likely appropriate and no changes are necessary.

Crappie Age-and-Growth Project

Title: The Effect of Harvest Regulations on Crappie Fisheries in Kansas Impoundments

James R. Miazga, Department of Fish, Wildlife, and Conservation Ecology, New Mexico State University; Zachary B. Klein, Department of Fish, Wildlife, and Conservation Ecology, New

Mexico State University; Jeff D. Koch, Kansas Department of Wildlife and Parks; Ben C. Neely, Kansas Department of Wildlife and Parks

Crappie populations are often managed with harvest regulations. However, specific guidance on how harvest regulations might improve crappie fisheries is lacking in Kansas. Given the limited knowledge, we 1) predicted the influence of restrictive daily creel limits on crappie harvest and 2) evaluated the influence of minimum length limits (MLL) on crappie fisheries throughout Kansas. Percent reduction in harvest was estimated under reduced daily creel limits. Equilibrium yield models were used to evaluate the effects of MLL on yield, harvest, and size structure. Creel surveys indicated that only 0.6% of anglers harvested a limit of 50 crappie/d. Therefore, daily creel limits would need to be less than 7 crappie/d to reduce harvest by greater than 25%. In general, a 254-mm MLL was most effective at improving yield and size structure. However, the efficacy of a 254-mm MLL was influenced by slow growth rates, high natural mortality rates, and low exploitation rates. Overall, MLL regulations are likely the most appropriate regulation for crappie fisheries and are best suited for populations characterized by fast growth rates, low natural mortality rates, and high exploitation rates. Our results provide a framework for managers to make informed decisions regarding implementation of harvest regulations in Kansas.

Michigan

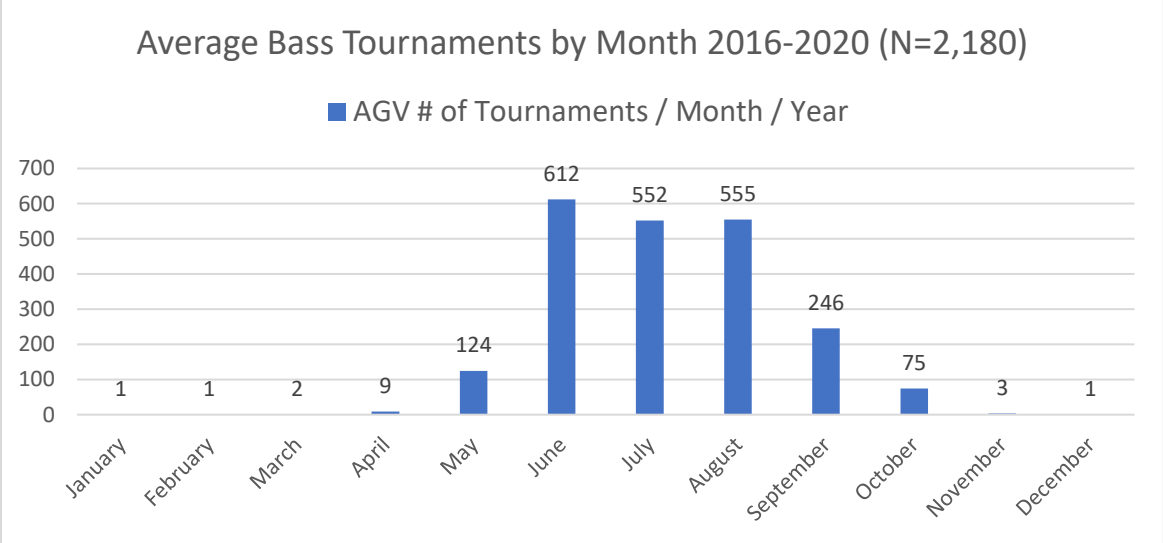
Registered Bass Fishing Tournament Summary 2016-2020

Beginning in 2016, all bass fishing tournaments in Michigan that meet the legal definition of a "Fishing Tournament" in Fisheries Order 250 are required to registered with the Michigan DNR and report their results after completion. This is a 100% online process.

2016-2020 Bass Fishing Tournament Information System Statistics

- 12,785 total registrations (AVG: 2,557 per year)
    - 663 where deleted (133 per year) – Directors can delete up to the scheduled start.
    - 1,220 where reported after the fact as having been canceled (244 per year)
    - 10,902 were believed to have occurred as registered (2,180 per year)
        - The required reports were received from 10,019 (91.9%)
        - The required reports were not received from 883 (8.1%)
    - There were 591 unique tournament directors (AVG: 263 registering per year)
- 366 unique waters hosted at least 1 tournament.
    - 52 hosted a single tournament (0.2 days per year)
    - L. St. Clair was the most popular with 361 tournament days (72.2 days per year)
    - Austin L. in Barry County was the most popular inland water with 253 tournament days (50.6 days per year).
    - 76 waterbodies in Michigan hosted 50 or more tournament days (10+ days per year).
- Tournament size in Michigan averages 25.7 angler per event.

- There were on average 56,000 angler entries and 319,000 angler hours spent in tournaments per year. This rivals the Michigan Great Lake Charter Boat Fishery.
- On average 44 bass are registered per event (1.71 fish per angler).
- 21.7% and 78.3% of bass entered statewide are smallmouth and largemouth, respectively.
- 97.9% of tournaments were registered as weight-based events (2.1% were judged by length).
- Average fish weight reported was 2.13 pounds.
- 44.5% of all tournaments reported catching at least one "quality" fish define as being 4 pounds or greater with at least 5% of the tournament fish entered exceeding this standard.
- The main tournament season is June – August.



Influence of tournament pressure and catch-and-immediate release regulations on smallmouth and largemouth bass population demographics.

Bass fishing is one of the most popular angling activities in Michigan, and therefore management of bass populations is a high priority. Bass fishing regulations in Michigan were a topic of great interest leading up to a regulation change in 2015 (effective April 9, 2015 via Fisheries Order 215.15) that allowed year-round catch-and-immediate release fishing. The regulation has now been in place for five years and there has not been an evaluation conducted to determine how bass populations throughout the state have been influenced, if at all.

In addition, bass fishing tournaments have been scrutinized by many stakeholder groups and some MDNR biologists throughout the years as being harmful to bass populations. It is hypothesized that bass fishing tournaments add a level of mortality to the populations that might not be sustainable, especially tournaments that are held during the spawning season or that occur on relatively small lakes. If this were concern were realized it would be expected that recruitment would be reduced, and younger age classes would be underrepresented in the population. Since 2016, bass fishing tournaments have been required to register and report so the MDNR has four years of data to address the objectives described below.

Objectives for the project are to 1) develop a model that describes fishing tournament patterns in Michigan; 2) determine if bass population demographics differ among lakes with differing fishing tournament pressure; and 3) determine if bass population demographics differ before and after the CIR regulation became effective. Age structure, size structure, growth rates, and catch rates data from DNR standardized surveys will be used to evaluate changes in bass populations. This study will examine how Michigan's bass population metrics have changed following a major regulation change and will provide insight into whether fishing tournaments or CIR have any measurable influence on bass populations. This study will inform management in Michigan and other regional states as well as identify future data needs.

Michigan DNR forms internal committee focused on bass management

DNR Fisheries Biologists approved an issue statement to form an internal committee to evaluate bass management in Michigan. The committee will focus on providing recommendations to better inform black bass management in Michigan waters. The committee is in the early stages and specific objectives and goals as well as terms of reference are still being formulated. Expect more information in future reports.

Panfish Management Evaluation

Michigan DNR will be discussing a plan to evaluate Bluegill regulations in the state. Initial proposed steps are to form a task force to develop an angler survey to evaluate interest and need for additional regulations for managing panfish in lakes. The proposal also calls for the development of a panfish management plan and experimental implementation and evaluation of regulations. More information will be available if the proposal is accepted.

Northern Lake Michigan Smallmouth Bass Movement

The Michigan DNR and Central Michigan University are continuing an evaluation of smallmouth bass movement in northern Lake Michigan. In 2021, smallmouth bass were collected in trap nets and tagged near Waugoshance Point, the Beaver Island Archipelago, and in East Grand Traverse Bay areas. This effort is part of a multi-year effort to evaluate special regulations and movement between these locations.

Minnesota

Summary of activities on **Panfish**:

Background

Every year the Section of Fisheries reviews fish survey data and angler input to determine the need for changes to special or experimental fishing regulations. Special and experimental regulations are lake specific and differ from statewide regulations. Changes vary but generally include new regulations, modifications to existing regulations or complete repeal of existing regulations. The need for change is driven by changes in fish populations, angler preferences, and/or statewide initiatives.

This memo is intended to present the findings from the public input process and FAW's recommendations for changes to adopt. Changes under consideration fall into three categories:

1. New daily limit reductions on sunfish and/or crappie (second year of the Quality Sunfish Initiative (QSI)),
2. Adjust existing sunfish and crappie special regulations by increasing possession limits but retaining long-standing reduced daily limits on 70 individual waterbodies (part of QSI and intended to avoid regulation complexity), and
3. Review of existing experimental walleye regulation on Clear Lake (Washington County).

Public input taken and modifications

Input was taken on the various proposals using multiple methods. A voluntary online survey was offered for the second year in a row from June 11th through October 31st. Overall, 1,890 responses were submitted via the online survey with the majority (62%) of respondents self-identifying as non-lakeshore owning Minnesota residents. In-person meetings were held in 27 counties including one open house for statewide comments – attendance was relatively low (max = 14, min = 0, median = 1). DNR staff in Waterville incorporated survey questions into 1,268 interviews conducted during two creel surveys. Finally, comments were sent directly to Area Fisheries Offices and/or directly to me. When all forms of input are combined, we received 3,747 comments.

1. QSI – year two

Generally, public support for nearly all of the proposals was strong however DNR staff did make some changes to a few proposals. Of the 53 newly proposed QSI lakes, 49 are recommended for adoption as proposed. Two lakes (Boy Lake in Cass County and Shields Lake in Rice County) were proposed for a daily limit of five sunfish but are being recommended for adoption as a daily limit of 10 sunfish in response to public input. One lake (Middle Lake in Otter Tail County) was proposed for a daily limit of 10 sunfish but is being recommended for adoption as a daily limit of five in response to public input. The QSI proposal for Shields Lake (Rice County) is being postponed due to some public opposition and an upcoming creel survey that will clarify the biological and social support for the change.

2. Adjusting existing sunfish and crappie possession limits

Public input on proposed adjustments to existing sunfish and crappie possession limits was solicited in a grouped manner as a single proposal (as opposed to individual lakes) given the goal was to reduce unnecessary complexity. Very few comments were submitted directly to DNR staff on this proposal but 1,775 responses were submitted via the online survey. Of those responses, 59% were supportive, 11% were neutral, and 29% were opposed. The few direct comments submitted came from resort owners who were opposed to the change because they were concerned that sunfish harvest would increase. However, previous studies and creel survey data suggest that increasing the possession limit on top of an existing reduced daily limit will have little to no observable impact on sunfish size.

Table 1. Special and experimental fishing regulations proposed for implementation in 2022. Special regulation proposals associated with the Quality Sunfish Initiative are summarized by regulation.

Scope	Recommended Regulation Change
New Special Regulations (QSI)	
23 waterbodies	Sunfish: Daily limit 5
21 waterbodies	Sunfish: Daily limit 10
6 waterbodies	Sunfish: Daily limit 5. Crappie: Daily limit 5.
1 waterbody	Sunfish: Daily limit 10. Crappie: Daily limit 5.
1 waterbody	Crappie: Daily limit 5
Adjust existing sunfish and crappie possession limits	
70 waterbodies	Statewide possession limits, retain reduced daily limits

Summary of activities on **Bass:**

We came up with a draft of Smallmouth Bass Sampling protocol in non-wadeable rivers (still in progress), took a stab at Toolbox regulation simplification via modeling in FAMS (still in progress with additional otoliths being examined), and sent an issue brief to the fisheries management team on allowing year-round angling for bass, with accompanying data from all electrofishing and IBI sampling.

Missouri

- No report. Change in the staffing structure of the Missouri Department of Conservation means that the Missouri state representative to the Centrarchid Technical Committee will be changing in 2022.

Nebraska

Evaluation of artificial habitat structures by the University of Nebraska-Kearney continued in 2021. The paragraphs below were provided by Logan Dietrich, the UNK graduate student in charge of the artificial habitat evaluation. The information provided by this study will help NGPC better understand how Georgia cubes affect a fish population in small impoundments and could help drive decisions on where they are used in the future.

The first objective of this study is to assess overwinter survival of bluegill and largemouth bass in three pairs (3 test and 3 control) of small impoundments in central Nebraska in response to the addition of Georgia cubes. Georgia cube structures were built and deployed into Sandy Channel SRA Lake #2, Ft. Kearny SRA Lake #5, and Windmill SRA Lake #2 in central Nebraska in fall 2020. Cube complexes were composed of three Georgia cubes that included one cube of standard configuration and two cubes each wrapped in a different size mesh (2.5 cm and 5.1 cm) to protect smaller fishes from predation. Three to five cube complexes were added to each test lake in fall 2020 based on the surface area of each waterbody. Nighttime boat electrofishing was conducted in fall 2020 and spring 2021 along with mini fyke nets in 2021 on all test and control lakes. CPUE’s of bluegill and largemouth bass were compared from fall 2020 to spring 2021.

Results indicate that Georgia cube complexes help increase overwinter survival of bluegill and largemouth bass although results varied between each set of lakes. Electrofishing efforts resumed in the fall 2021. Sampling will resume in the spring of 2022 (electrofishing and mini fyke nets) and comparisons between fall 2021 and spring 2022 CPUE's will be assessed. These results compared with the previous years will allow for a better understanding of the effectiveness that Georgia cubes have for improving overwinter survival of bluegill and largemouth bass in small impoundments.

The second objective of this study is to assess the spatial footprint or effective area of Georgia cubes monthly, based on the spatial associations of fish to the structures. Three sets of standard Georgia cube complexes were built and deployed into Cheyenne SRA Lake and West Wood River WMA Lake in central Nebraska in fall 2020. A variety of sampling gears and methods have been used to assess fish use on these two lakes. Passive integrated transponder (PIT) tags were placed in bluegill, black crappie, largemouth bass, and channel catfish in the spring and fall 2021. Active tracking of fish was conducted monthly from May through August 2021. A single monthly electrofishing effort (day and night) was also conducted from May through December 2021 at set distances around each Georgia cube complex. A series of Aqua-Vu videos were recorded monthly from May through December 2021 around the Georgia cube complexes. Preliminary results indicate differing seasonal use of Georgia cube structures within these lakes. Research is ongoing with more results expected to come later in 2022.

Ohio

Lake Erie Smallmouth Bass Telemetry

Zak Slagle and Matt Faust (ODNR-Division of Wildlife) received funding from Ohio Sea Grant for a Lake Erie Smallmouth Bass telemetry study that will occur over the next two years. They plan to compare daily movement, seasonal migration, and habitat use between Smallmouth Bass captured by anglers and those collected in electrofishing surveys.

Genetic and Environmental Effects on Largemouth Bass Population Structure in Reservoirs

ODNR-DOW is funding a PhD student (Rachael Finigan) at Ohio State to investigate genetic and environmental effects on Largemouth Bass population structure in Ohio reservoirs. She has been analyzing standard Largemouth Bass survey data in our long-term database and will complete a common garden experiment in 2022 using juvenile Largemouth Bass from two reservoirs to assess genetic and environmental effects on early-life growth.

Review of Black Bass Regulations

Steve Tyszko has been working with other biologists (Jeremy Pritt, Joe Conroy, and Kevin Page) at the Inland Fisheries Research Unit to evaluate the utility of our black bass regulations for managing Largemouth Bass fisheries in Ohio reservoirs and will be presenting this work in the Harvest Management in Recreational Fishing and Hunting symposium at the 82nd Midwest Fish and Wildlife Conference.

Statewide Centrarchid Sampling

In addition, we continued to complete fish population surveys for black bass in Ohio reservoirs using the North American standard electrofishing method and crappies and sunfish in Ohio reservoirs using the North American standard fyke net method. Ohio River black bass surveys were completed by electrofishing in tributaries and embayments during October. Lake Erie centrarchid sampling includes gill net surveys for Smallmouth Bass and nearshore electrofishing for Largemouth Bass.

Wisconsin

Centrarchid Panfish

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 2021-2022, we will analyze these data and conduct accompanying angler surveys. While the experiment is scheduled to run until 2026, this analysis will provide the first statewide peek into responses to these regulations. 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.).

Angler responses to experimental regulations

An initial examination of angling pressure suggests anglers are responding to the new regulations. Researchers from UW-Stevens Point placed car counters at landings on 6-8 treatment and reference lakes in the summers of 2015 and 2021 as a proxy for measuring angling effort. Overall effort did not change, but there was a significant interaction between year and lake, suggesting some shifting of effort away from treatment lakes with more restrictive regulations onto reference lakes (which maintained a liberal 25 fish bag limit). This work will be presented at the WI AFS Chapter meeting in 2022 and later developed into a manuscript.

Effects of regulation on angling rates and size selectivity

Panfish Team recently published an analysis of angler responses to regulation, comparing total effort, catch and harvest rates, individual angling rates, and size selectivity among anglers fishing lakes with bag limits varying from 50, 25, or 10 panfish per day. Total effort, catch, and harvest did not vary among regulations, although release rates increased and more anglers (although only 10%) reached the bag limit under a 10-bag. Anglers also selected for harvesting larger bluegill, black crappie, and yellow perch under a 10-bag compared to either more liberal bag limit, which allowed them to maintain their filet yield (i.e., grams of filet harvested per angler) despite keeping slightly fewer fish. This has now been published in the book *New Paradigms in Harvest Management* (Feiner et al. 2021).

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. We will be requesting bluegill data from agencies within the NCD in the next month or so.

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 are 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 will use creel surveys to analyze angler pre-trip catch rate expectations and their end of trip catch rates, as well as their satisfaction. Additionally, we will collect demographic information about ice anglers in urban and rural areas of Wisconsin to better understand which populations of anglers utilize

these technologies while fishing. Finally, we will conduct experimental angling to test the effects of these technologies on bluegill catch rates. These results will be used to expand the currently limited understanding of ice fishing technology and the anglers who use them to better manage Bluegill fisheries. Creel surveys will be performed by UW-Madison and WDNR staff in winter 2021-2022 on a subset of lakes in northern and southern Wisconsin. Initial results and workplan will be presented at the Midwest Fish and Wildlife Conference in 2022.

Ice angling catch and release mortality of bluegills

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

Students and staff with the University of Wisconsin-Madison Center for Limnology and WDNR are designing a study to examine catch and release mortality of bluegills caught during ice fishing. Bluegills will be sampled via hook and line, implanted with a PIT tag, and released into fish traps where their survival can be monitored over time in a small lake in southern Wisconsin. Fishing will occur on multiple days to capture a range of air temperatures, fish sizes, and handling times. A pilot study for this project on Lake Wingra, Madison, WI, yielded high mortality due to problems tagging fish and stress in the fish traps. This study is being re-examined for either winter 2022 or 2023.

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 catch rates. In the summer of 2020, baseline population estimates were conducted for largemouth bass and bluegill in Jones Lake (treatment lake) and Crampton Lake (reference lake). Largemouth bass habitat use was also monitored using acoustic telemetry in both study lakes. In winter 2020/2021, coarse woody habitat will be added to the littoral zone of Jones Lake. During summer 2021, largemouth bass habitat use will be monitored to test for behavioral responses to the littoral habitat enhancement. In summer 2022, largemouth bass will be systematically removed from Jones Lake in a standardized angling experiment to test for: 1) the influence of habitat addition as a mechanism explaining hyperstability in largemouth bass catch rates; and 2) the density-dependent breakpoint where largemouth bass density is reduced enough to improve population size structure and individual growth rates.

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.

Climate-induced shifts in hatch timing and the expansion of largemouth bass on the northern front

Submitted by Giancarlo Coppola (Wisconsin Cooperative Fishery Unit, UW-Stevens Point) and Daniel Isermann (USGS Wisconsin Cooperative Fishery Unit, UW-Stevens Point; dan.isermann@uwsp.edu)

Climate-induced shifts in phenology have significant implications for community ecology and ecosystem management. Understanding these shifts and their implications is particularly relevant for warmwater fish species near the upper latitudinal limit of their range, as this “front” represents the greatest opportunity for population growth and range expansion. We used largemouth bass *Micropterus salmoides* in Wisconsin lakes to assess whether shifts in phenology (hatch timing) were apparent and to predict how these shifts might influence early life history and survival. Total length distributions of age-0 bass in northern Wisconsin lakes during 1995-2006 were not significantly different than distributions from 2017-2020, suggesting hatch timing had not markedly increased. Information from 746 age-0 bass collected from ten lakes during 2012 and 2013 suggest that > 90% of largemouth bass in Wisconsin lakes hatch between May 23 and June 24 and typically do not switch to piscivory, a ontogenic diet shift considered important to growth and survival, until their second summer. Simple projections suggests that shifts in hatch timing of 1 week could affect the numbers of age-0 largemouth bass in Wisconsin lakes reaching total lengths associated with the onset of piscivory and overwinter survival. Earlier hatch dates coupled with increasing growth rates resulted in significant shifts in projected pre-

winter total length distributions of age-0 largemouth bass, indicating that largemouth bass may continue to increase in abundance through higher recruitment.

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 recently submitted to a special issue of Fisheries Management and Ecology focusing on the RAD framework (Feiner et al., in review).

Assessing abundance of centrarchids in northern Wisconsin lakes with different walleye recruitment histories

Submitted by Ethan Brandt (Wisconsin Cooperative Fishery Unit, University of Wisconsin-Stevens Point) and Daniel Isermann (USGS-Wisconsin Cooperative Fishery Unit, University of Wisconsin-Stevens Point; dan.isermann@uwsp.edu)

Our goals were to identify gears that can be used to effectively sample small centrarchids and to determine if current and historical relative abundance estimates of centrarchids were related to walleye recruitment history. Eleven northern Wisconsin lakes were sampled over two sampling seasons were completed during 2019 and 2020 using mini-fyke nets, cloverleaf traps, standard boat electrofishing, and electrofishing from a boat using a hand-held probe. Boat electrofishing and mini-fyke nets sampled a similar range of centrarchid species; however, the effectiveness of these gears was dependent upon shoreline characteristics, which varied by lake. Thus, both gears may need to be used in conjunction to obtain a more accurate representation of the centrarchid fish community. Current and historical centrarchid abundance was not related to walleye recruitment history and this suggests that sustained walleye recruitment can occur in lakes with

relatively high abundance of centrarchids. Most effective methods for sampling juvenile centrarchids varied among species.

Effects of centrarchid removal on population dynamics and demographics

Submitted by Holly Embke (Center for Limnology, University of Wisconsin-Madison; hembke@wisc.edu) and Daniel Isermann (USGS-Wisconsin Cooperative Fishery Unit, University of Wisconsin-Stevens Point)

The Center for Limnology at UW-Madison, the Wisconsin Cooperative Fishery Research Unit at UW-Stevens Point, and the WDNR completed their fourth year (2018-2020) of experimental removal of centrarchids in McDermott Lake, WI (33.1 ha), to assess the effects of removal on walleye recruitment and the population dynamics and demographics of centrarchids. The fish community has been closely monitored since 2017 when the project was initiated and will continue in 2021. More than >280,000 centrarchids have been removed since 2018. There has been no evidence of natural walleye recruitment throughout the study period, but yellow perch have appeared to increase. Since the removal began, relative abundance of age 1+ black crappie has declined and most CPUE indices suggest bluegill abundance has also declined. Conversely, largemouth bass abundance has remained relatively constant. We will continue to monitor the lake ecosystem in 2022 and begin to determine how the removal has influenced centrarchid recruitment and growth.

Fish community changes associated with bullhead removals in four northern Wisconsin lakes

Submitted by Logan Sikora (UW-Stevens Point; lsikora@uwsp.edu), Justin VanDeHey (UW-Stevens Point), Greg Sass (WDNR), Greg Matzke (WDNR), and Michael Preul (Sokaogon Chippewa Community, Mole Lake Band of Lake Superior Chippewa Indians)

Bullheads *Ameiurus spp.* are found throughout much of the United States and are infrequently studied species. Although limited information has been published on the Black Bullhead *A. melas* and Yellow Bullhead *A. natalis*, it has been shown that bullheads can dominate the fish biomass in some north temperate U.S. lakes, resulting in a fish community exclusive of Walleye *Sander vitreus* and Yellow Perch *Perca flavescens*. Recently, recruitment and abundances of popular coolwater sport fishes, such as Walleye and Yellow Perch, have been declining in some northern Wisconsin lakes. These observed declines, coupled with high bullhead densities, led fisheries biologists to conduct whole-lake bullhead removals on four northern Wisconsin lakes. Removal of Black and Yellow bullheads from these lakes resulted in substantial changes in the fish communities. The CPUE of naturally reproduced age-0 Walleye increased in Lake Metonga and Patten Lake following the removal of bullheads. Additionally, survival of stocked Walleye increased in Crane and Pickerel lakes after bullhead removals, resulting in higher CPUE of age-0 and age-1 Walleye. Subsequently, adult Walleye abundance has increased or remained steady in all bullhead removal lakes. Significant declines in abundance of Bluegill *Lepomis macrochirus* and increases in abundance of Yellow Perch and Black Crappie *Pomoxis nigromaculatus* were also observed after bullhead removals, further illustrating a shift in fish community composition.

Our observations suggest that when at high densities, bullheads can play a significant role in structuring fish communities and the removal of bullheads can increase recruitment, survival, and abundance of sport fishes like Walleye and Yellow Perch. This work was published in North American Journal of Fisheries Management (Sikora et al. 2021).

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. This project is currently being developed in a manuscript for publication in 2022.

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 is currently in preparation for submission in early 2022.

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.