North Central Division American Fisheries Society

Centrarchid Technical Committee

2020 Annual Report

Dakota

Bluegill Exploitation in Northeast South Dakota

Research began at Lake Enemy Swim in 2019 to examine Bluegill population dynamics in select northeast South Dakota lakes. Pickerel Lake was added as a study lake in 2020. At both lakes, Bluegills were collected in modified-fyke nets during May and June 2020 for tagging and completing a mark-recapture population estimate. The scheduled creel survey for the 2020 summer was not completed but the creel should resume during the 2020-21 winter.

In 2020, 999 (150 $100 reward, 849 non-reward) Bluegills (≥150 mm TL) were tagged in Lake Enemy Swim, and 1,000 (100 $100 reward, 900 non-reward) were tagged in Pickerel Lake. The population estimate of Bluegills ≥150 mm TL at Enemy Swim Lake was 21,989 (95%CI 18,720-26,641) fish and at Pickerel Lake, the estimate was 20,585 (95% CI 12,220-28,950) fish. As expected, non-reward tags appear to have poor angler reporting rates based on the difference in the number of fish reported as harvested for each tag type. Anglers reported harvesting 114 (13% exploitation) of the Bluegill tagged with non-reward tags in 2020 and 41 (27% exploitation) of the 2020 reward-tagged fish from Lake Enemy Swim. At Pickerel Lake, 144 (16%) non-reward tags were reported as harvested and 47 (47%) reward-tagged fish were harvested. Based on the 2020 reward-tag returns for only the summer, it appears that angler harvest can be fairly substantial and will likely increase with ice fishing.

In 2021, additional Bluegill will be tagged in both Enemy Swim Lake and Pickerel Lake and current plans include a summer creel survey. A third lake is scheduled to be added in 2022 and tagging on Lake Enemy Swim will be done.

Evaluation of Angler Catchability of Hybrid Sunfish (Male Bluegill x Female Green Sunfish) for Use in Community Fisheries

We assessed the catchability of 100 stocked hybrid sunfish (male Bluegill *Lepomis macrochirus* X female Green Sunfish *Lepomis cyanellu*s) in a 0.12-ha pond before and after being subjected to angling (four, 1-h fishing events with five anglers). We also investigated whether catch rates would change following a supplemental stocking of an additional 100 hybrid sunfish (four, 1-h fishing events with five anglers). Angler catch rates were highest during initial fishing events that followed stocking (9.2 fish/h and 18.0 fish/h) and substantially declined in subsequent events (≤ 3.4 fish/h). Catches of the newly stocked fish and previously stocked fish contributed to the high catch following the supplemental stocking. Most (80%) of the fish were caught in the first 30 minutes of each event and 45% were caught during the first 10 minutes. Anglers were able to catch 88% of the fish from the first stocking and 67% from the second stocking at least once. Hybrid sunfish will initially provide high catch rates following stocking, but managers should expect reduced catch rates following initial fishing even without harvest. Additional stocking will be needed to provide periodic increases in angler catch rates.

Iowa

Iowa Centrarchid Technical Committee Update – Brandon Maahs and Dr. Michael Weber

Live release Largemouth Bass (*Micropterus salmoides*; hereafter referred to as bass) tournaments are popular throughout the United States, but despite anglers' best efforts to increase tournament bass survival, confinement and weigh-in stressors still result in tournament mortality. In 2018, Iowa legislature passed a law that increased the bag limit from three bass to five bass and reduced the minimum length limit from >381 mm to no minimum length limit for bass tournament anglers. This regulation change provided an opportunity to evaluate the effects of length and bag limits on bass tournament survival and if length and bag regulations could be used to reduce bass tournament mortality. A mark-recapture study was conducted on Brushy Creek Lake, Iowa from 2015-2019 where bass were collected and tagged during all tournaments (n = 205) and monthly electrofishing events. Survival of tournament weighed in bass was reduced over a 3-day period post-release with water temperature having the greatest effect on post-release survival. Bass survival was also reduced as the number of bass in a live-well

increased from 1 to 15; however, reduced survival due to crowded live-wells likely has minimal population effects due to the infrequency of ten or more bass observed in a live-well.

Tournament anglers weighed in an average of 0.26 bass per angler per tournament hour, resulting in bag limits having a minimal effect on managing the probability of a bass being weighed in and subjected to tournament stress. To reduce the number of bass weighed in and subsequent tournament mortality by more than 25%, tournament bag limits would need to be reduced <2 bass. However, bass catchability was highest during the spring and fall when tournament mortality was lowest due to cool water temperatures, further reducing the potential for bag limits to reduce tournament mortality. Thus, in instances where tournament mortality is an issue, other management methods not affected by low bass catchability may provide a more reliable option to reduce number of bass weighed in and the associated tournament mortality.

Our work assessing potential population level effects of tournament mortality on bass populations has resulted in a number of recent publications, with more forthcoming. Stay tuned!

Fernholz, S, A Sylvia, and MJ Weber. 2018. Hook wound longevity and use as an indicator of Largemouth Bass catch-and-release angling pressure. North American Journal of Fisheries Management 38: 759-768.

Maahs, B. 2020. Effects of live-release tournament regulation changes for an Iowa Largemouth Bass population. MS thesis, Iowa State University, Ames.

Sylvia, A. 2019. Environmental and anthropocentric effects on Largemouth Bass populations. PhD dissertation, Iowa State University, Ames.

Sylvia, A, S Dinsmore, and MJ Weber. *In review*. Tournament and recreational anglers have little effect on a Largemouth Bass population compared to natural mortality. Canadian Journal of Fisheries and Aquatic Sciences.

Sylvia, A, BC Maahs, and MJ Weber. *In press*. Shifting paradigms in harvest management: a case study using Largemouth Bass. In Harvest of Fish and Wildlife: new Paradigms for Sustainable Management. L Powell and KJ Pope, editors.

Sylvia, A, BC Maahs, and MJ Weber. 2020. Influence of Largemouth Bass behaviors, angler behaviors, and environmental conditions on fishing tournament capture success. Transactions of the American Fisheries Society 149: 93-107.

Sylvia, A, and MJ Weber. 2019. Use of a mark-recapture model to estimate delayed catch and release mortality of Largemouth Bass at tournaments. Fisheries Research 219: 105335.

Illinois

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

Nerissa McClelland, Illinois Department of Natural Resources

The IDNR Fish Hatchery System stocked 7,242 - 4" black crappie into the Starved Rock Pool of the Illinois River.

Mike Mounce, Illinois Department of Natural Resources

We have been using both Georgia cubes and Shelbyville cubes at Lake Shelbyville. The anglers have told us that the Shelbyville cubes are more effective than the Georgia cubes and to quit building the Georgia cubes. This is anecdotal information, but I think it is worthy of noting.

Since last year, we do not have any additional information on Walnut Point Lake (21 ha.) bluegill regulation. I briefly looked at some data and am wondering if increasing the creel limit from 15 per day to 20 per day may be resulting in overharvest of bluegill under 8-inches, resulting in reduced recruitment over 8 inches in this small impoundment. I have been unable to look into this further. The current regulation is: 20 bluegill/redear per day, only 5 can be 8-inches or longer.

Lastly, there is much concern among fisheries professionals, business owners, and anglers over what the new improvements in fishing electronics, sonar, and trolling motors will do to increasing the effects of angling pressure on the quality of fisheries. I have been told that a tournament was won by a couple of local anglers using the Garmin “Livescope” and targeting only the largest crappie in schools found. My single experience with this technology in an icefishing situation was that it was astoundingly effective at a novel fishing location.

University Research:

Dr. Eloy Martinez, Easter Illinois University, Integrative Physiology Lab

Evaluating seasonal variation in mitochondrial bioenergetics and physiological performance of the bluegill sunfish, *Lepomis macrochirus,* from a shallow Midwest river.

Abstract

As average global temperature increase, the frequency and magnitude of extreme temperatures in shallow aquatic ecosystems are more ubiquitous. In order to understand how these changing thermal regimes affect aquatic ectotherms, it is essential to develop studies evaluating the response of ectotherms to seasonal fluctuating thermal regimes. Previous studies on fluctuating temperature regimes have reported an increased physiological stress leading to morphological, behavioral and biochemical adaptations. From the latter, the adaptive capacity and seasonal performance associated with optimal function of the oxidative phosphorylation system (OXPHOS) are key for species persistence. However, studies on this matter are scarce. This study explores the seasonal changes and thermal sensitivity of the OXPHOS system in liver mitochondria of the bluegill sunfish species *Lepomis macrochirus,* inhabiting a shallow riverine system. Our study on liver mitochondria from *L. macrochirus* show significantly higher uncoupled proton conductance (LEAK) and cytochrome c oxidase (COX) activity in individuals captured in the fall compared to specimens investigated in summer and spring seasons. Flux control ratios such as coupling control ratio (CCR) and respiratory control ratio (RCR) were significantly reduced in the fall compared to warm-acclimated individuals in the summer and spring. These findings suggest that mechanisms regulating COX activity are in place to fine-tune mitochondrial function, and consequentially increase fitness in ectotherms inhabiting shallow, aquatic habitats with highly fluctuating temperatures.

Fluctuating temperatures in a Midwestern river and its effects on physiological thresholds in a freshwater fish species *Lepomis macrochirus*

Abstract

Extreme temperatures are becoming more frequent and seasons less predictable, particularly in temperate zones. In the Midwestern United States, extreme temperature variations are not uncommon especially in the spring and fall seasons. Many physiological studies have reported

the effects of warmer temperatures on numerous aquatic species; however, these studies sometimes disregard seasonal temperature changes experienced in aquatic systems. In our study, we surveyed a native fish population (*Lepomis macrochirus)* seasonally in 2019. Results showed varying population structure and physiological thresholds in relation to fluctuating temperatures. Somatic indices, such as relative weights and hepatosomatic indices showed significant differences among seasons ($p < 0.05$). Critical thermal maximums showed a significant decrease from warmer to colder temperatures ($p < 0.001$). Our study indicates that shallow-dwelling fish species such as the *L. macrochirus* residing in fluctuating habitats, may lead to changes in the physiological performance, body condition, and energy storage, primarily when exposed to extreme differences in temperatures.

Kyle Rempe, Easter Illinois University, Integrative Physiology Lab

We are continuing to look at Black Crappie and Bluegill found in Coffeen Lake, which shut off warm water discharge in October 2019. The focus of this project is to combine age and growth work from sagittal otoliths along with physiological work from mitochondrial efficiency in order to shape the thermal tolerance of both species. By combining growth and bioenergetics into a two-prong approach, some interesting results have been found so far.

Warm water temperatures may lead to higher energetic demands from Black Crappie, and results suggest that they are more limited by Electron Transport System (ETS) capacity when compared to Bluegill. Fall 2019 oxygraph runs at 30˚C showed coupling ratios of Adenosine triphosphate (ATP) production divided by the ETS capacity (P/E) of 0.96 for Black Crappie, compared to 0.84 for Bluegill (two-way ANOVA, $p=0.001$). This could explain why Black Crappie were previously found more abundantly in less thermally impacted regions of Coffeen Lake. Because Bluegill are capable of adjusting their biomechanical machinery, some energetic tradeoffs in their growth are apparent. Additionally, there are noticeable differences in how Bluegill perform between seasons (Spring and Fall) based off values seen for proton leakage and Adenosine triphosphate (ATP) production efficiency.

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

(1) We have an ongoing project evaluating the potential of harvest regulations for managing size structure of crappie and bluegill populations. This study will evaluate regulations over multiple years, include control lakes for comparison, and combine collections of creel survey and biological data. Experimental crappie regulations have been proposed for implementation in 2021 and Bluegill in 2022.

(2) We have been conducting a variety of research projects investigating the effects of adding habitat structure to habitat-limited reservoirs. This includes PVC-frame cubes in Lake Shelbyville coves, whole-lake addition of felled trees in Walnut Point, and coarse woody habitat in urban fishing lakes in the Chicago area. The urban lakes project is still in the pre-data collection phase, with plans to add habitat in 2022. Because of their attraction to structured habitat, Centrarchid species have had some of the strongest responses to the habitat additions. These projects are examining both the behavioral responses (e.g., fish attraction) and potential changes to overall productivity of aquatic biota.

(3) In publication news, our lab published a paper in the journal Fisheries Management and Ecology that details how the fishing efficiency of largemouth bass tournament anglers in IL has increased over time (likely due to the increased use and performance of fish-finding technology).

Dr. John Chick, Illinois Natural History Survey, Great Rivers Field Station

Chick et al. (2020) completed a manuscript looking at the impact of invasive silver carp on native sport fish, including nine centrarchids, in the Upper Mississippi River System.

Chick, J.H., Gibson-Reinemer, D.K., Soeken-Gittinger, L. *et al.* 2020.Invasive silver carp is empirically linked to declines of native sport fish in the Upper Mississippi River System. *Biol Invasions* 22, 723–734. DOI: 10.1007/s10530-019-02124-4

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

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

The Emiquon Preserve 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 study 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.

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

Staff of the Illinois River Biological Station and collaborators completed a manuscript entitled Spatial variation in bluegill population demographics in a highly modified large river, which examined age and length at capture, growth, fecundity, and body condition of bluegill in two different river reaches of the Illinois River and a disconnected floodplain lake.

Whitten, A.L., J.A. DeBoer, L.E. Solomon, A.K. Fritts, M.W. Fritts, R.M. Pendleton, T.D. VanMiddlesworth, A. F. Casper. 2020. Spatial variation in bluegill population demographics in a highly modified large river system. Journal of Freshwater Ecology. 35:1, 303-320. DOI: 10.1080/02705060.2020.1806122

Indiana

Indiana Department of Environmental Management, Indian Department of Natural Resources, and Muncie Sanitary District's Bureau of Water Quality

White River Mainstem Project

This year has been one for the records for so many reasons, but 2020 will also go down as a history making year in the Indiana fisheries survey world. Three agencies Indiana Department of Environmental Management (IDEM), Indiana Department of Natural Resources (IN DNR), and the Muncie Sanitary District's Bureau of Water Quality (BWQ) set the ambitious task to sample the West Fork White River and White River mainstem from its headwaters to its confluence with the Wabash River during the summer and fall of 2020.

The project entailed 62 fish electrofishing sampling sites, 59 water chemistry (taken in three rounds, once in spring, summer, and fall) sites, and 11 macroinvertebrate sampling sites. A project of this magnitude is unheard of in Indiana and rare across the United States. Twenty-two personal from three agencies collected over 17,000 fish and 92 species along the entire 356 river miles from the headwaters in Randolph County to the confluence with the Wabash River.

To keep updated on the results of the project please check out https://idem.in.gov/WhiteRiverProject. Sampling results will be updated to the webpage as they become available.

Indiana Department of Natural Resources

Surveys of Dogwood and Hardy Lakes

Division of Fish and Wildlife (DFW) South Region Fisheries Research Biologists continued their annual monitoring of the 9-inch minimum length limit at Dogwood and Hardy lakes in 2020. Dogwood lake was sampled from March 9 – 13, 2020 with 22 Michigan style trap nets and 51 Indiana standard net lifts, resulting in a total of 142 Black Crappie ranging in size from 7.1 – 13.8 inches and weighing a total of 68.3 pounds. Proportional size distribution was similar to previous years; however, the overall number of fish 9 inches and larger was lower than 2018 and 2019 (Table 1, Figure 1). Body condition of fish at all sizes continues to remain stable, indicating a healthy crappie population.

The annual crappie survey at Hardy Lake ran from October 26 – 30, 2020 and consisted of 4 Michigan style trap nets and 6 Indiana standard net lifts, resulting in a total of 607 Black Crappie ranging in size from 3.8 – 12.3 inches and weighing a total of 158.1 pounds. Proportional size

distribution remains low with only 17% of fish sampled over 9 inches (Table 2). Furthermore, stockpiling of fish right under the 9-inch limit seems to be occurring (Figure 2). Body condition of fish continues to decline, indicating high levels of competition potentially from high abundance of crappie. Thirteen White Crappie were also sampled, ranging in size from 6.9 – 14.8 inches and weighing a total of 4.5 pounds. White crappie abundance was much lower than previous years. It is not known if this population is just at a low point of a cycle, or if changes in environmental conditions are favoring Black Crappie.

Yellow Bass were first detected in the lake in a 2009 survey and their abundance has increased substantially in the following decade. In a 2010 creel survey, just 80 Yellow bass were harvested. That number increased to an estimated harvest of 19,585 fish in 2018. Over that same time period, crappie harvest declined by 56%. The increased abundance of Yellow Bass and decreased harvest has likely contributed to stockpiling of crappie under the 9-inch minimum length limit.

Year	PSD	PSD-9	PSD-10	PSD-12	Wr-8	Wr-10	Wr-12
2014	60	43	19	3	101	101	97
2016	77	56	30	-	104	95	-
2017	90	64	23	1	88	88	82
2018	92	81	54	16	90	90	88
2019	92	82	51	8	91	92	93
2020	87	61	47	4	89	90	89

Table 1. Dogwood Lake Black Crappie PSD and relative weight values.

Year	PSD	PSD-9	PSD-10	PSD-12	Wr-8	Wr-10	Wr-12
2015	20	11	5	-	92	85	-
2016	59	36	7	-	102	95	-
2017	86	75	31	1	81	82	77
2018	54	42	21	1	87	81	79
2019	68	16	6	-	86	82	-
2020	68	17	2	-	83	77	82

Table 2. Hardy Lake Black Crappie PSD and relative weight values

Black Crappie Survey on Starve Hollow Lake

In early March before Covid-19 cancelled our fish sampling season, DFW District 5 biologists completed a Black Crappie survey at the 145-acre Starve Hollow Lake in Jackson Co., Indiana. The fish collection effort lasted from March 16 to 20, 2020 and consisted of 2 Michigan style trap nets and 4 standard Indiana style trap nets for a total of 24 overnight lifts. Water temperature ranged from 48.6F to 49.0F. A total of 118 black crappie with lengths ranging from 2.5 to 14.6 inches and a total weight of 61.42 lbs were collected. Catch per unit effort for the Indiana style Trap net was 4.18 fish/lift and 6.3 fish/lift for the Michigan Style trap nets. As part of the statewide crappie management plan, a subsample of crappie were aged with otoliths, and all fish were weighed. An age length key was created. Fish weights will be used to determine relative weights by mean stock indices and a yield per recruit model will be created. This data will also be used to determine if this Black Crappie fishery would benefit from having a minimum size limit. Currently Indiana has no size limit for crappie with a 25-fish bag limit.

A sample of Bluegill, Largemouth Bass and Black Crappie were sacrificed for Viral Hemorrhagic Septicemia testing as Starve Hollow Lake is the primary water supply for the Driftwood State Fish Hatchery.

Evaluation of Ruble Lake Stocking

In July, DFW District 5 biologists were able to evaluate the Ruble Lake stocking in Vigo County. Last year they renovated this lake, and the fish hatchery unit braved icy conditions to successfully restock the lake just before thanksgiving. This July, they found 5-inch, age-1 bluegill on beds and largemouth bass up to 10 inches. Daytime electrofishing in July was not ideal to find all species stocked. However, preliminary results are promising, and they will continue to monitor the progress.

Report Contributors

We thank Tom Bacula (IN DNR), Seth Bogue (IN DNR) Sandy Clark-Kolaks (IN DNR), David Kittaka (IDNR), Paul Stockebrand (IN DNR), Drew Holloway (BWQ) for their contributions to this report.

Kansas

- No report

Michigan

- No report

Minnesota

Bluegill Technical Committee Update

The biggest accomplishment was the proposal for reduced sunfish bag limits and subsequent public input collection and review on about 120 waters located around Minnesota. Proposals were based on fish survey data indicating biological potential for quality size structures coupled with indications of public support. Public opinion was further examined through various means, including local meetings, on-line regional meetings, and an on-line webpage and angler survey. The on-line survey was of particular interest because it generated over 3,500 responses. Greater than 80% of these responses supported the use of reduced bag limits on proposed lakes and on hundreds of additional lakes. Area offices have made recommendations based on the public input and these recommendations are currently under review by regional staff. Once the review is completed, proposals will be sent to the DNR commissioner's office for final consideration. If approved, proposed regulations will go into effect in 2021. Area Offices will also have an opportunity to propose additional lakes and collect additional public input in 2021.

Bass Technical Committee Update

Although our study and report was completed several years ago, our report on age structure comparisons for Largemouth Bass and Smallmouth Bass was just placed on the Minnesota DNR website (https://files.dnr.state.mn.us/publications/fisheries/investigational_reports/567.pdf). Overall, age estimates made with annuli counts on transverse views of sagittal otoliths of both species were more precise and unbiased compared to age estimates made with annuli counts on whole views of otoliths, scales, and dorsal spines. Additionally, although age estimates made with scales and whole otoliths appeared reliable for bass age 4 or younger, age estimates from dorsal spines were unreliable for all ages except age 1. Scales and otoliths from Largemouth Bass were examined from May through September to determine timing of annulus appearance in

three lakes in west central Minnesota. Preliminary analyses suggested that new annuli on scales started appearing by early June and all scales from two lakes had new annuli by the end of June. Completion of annulus appearance could not be determined in the third lake because annuli at the scale edge on some samples could not be distinguished from the scale edge. New annuli on transverse views of otoliths also started to appear by early June but appearance was not complete until late July in two lakes and not until late August in one lake. Generally, annuli on both structures from younger bass appeared earlier than on structures of older bass.

A member of the committee recently completed an evaluation of a voluntary creel survey by individual bass anglers. Unlike traditional angler diary programs, this creel survey was spearheaded by avid bass anglers who recruited and encouraged other bass anglers to voluntarily provide their angling catch data of Largemouth and Smallmouth bass in Minnesota waters. Minnesota DNR research biologists helped design the creel survey and analyzed all catch data collected from 2003 through 2019. Overall, length distributions of Largemouth Bass ≥ 12 in. caught by anglers did not differ from length distributions of the same length group of bass sampled with boom electrofishing in 36 of 40 comparisons; however, three of nine comparisons of Smallmouth Bass differed. If sustained, this creel survey program will provide to the Minnesota DNR additional data on size structure of Largemouth Bass. Lastly, a data set addressing freeze preservation effects on fish lengths was looked at. For both bass species, total lengths shrunk an average of 2% after being measured in the field, placed in a freezer for 4-6 months, and then thawed.

Missouri

The Missouri Department of Conservation (state conservation fish and wildlife organization) began implementing an agency-wide restructuring in July 2020. The restructure process combines the previous fisheries, forestry, and wildlife divisions into a singular resource management branch that carries out community and private land conservation activities (private land mgmt.) and public land resource management activities (public land mgmt.) at the regional level. At the statewide level, a fisheries section advises regional aquatic management.

The final report was completed on a cooperative project between the Missouri Department of Conservation (MDC) and the University of Missouri Fish and Wildlife Research Unit entitled ***"Determining Electrofishing Immobilization Thresholds of Smallmouth Bass, Blue Catfish, and Flathead Catfish: A Critical Step to Develop a Standardized Sampling Protocol".*** The executive summary of the report to MDC pertaining to smallmouth bass is provided below.

We examined the response to electrofishing of three Missouri sportfish: Smallmouth Bass, Blue Catfish, and Flathead Catfish. Phase 1 of this research effort had three objectives: 1) determine the effective conductivity of each species and whether this value differs from recommended values; 2) determine the effect of waveform, fish size, and water temperature on capture-prone response thresholds of each species; and 3) develop power goals and sampling recommendations for each species. We found that the effective conductivity of Smallmouth Bass, Blue Catfish, and Flathead Catfish were 123 μS/cm, 69 μS/cm, and 94 μS/cm, respectively. Phase 2 of this research had two objectives: 1) determine if the capture probability differs by species, fish size, water temperature, and equipment settings (i.e., power output, waveform selection); and 2) discuss how capture probability and equipment settings can be incorporated into recommendations used to inform standardized sampling protocols for these species in Missouri. A detailed summary of final recommendations can be found in the Management Implications and Recommendations chapter (i.e., chapter eight) of this report. Below is a brief summary of suggested modifications to current sampling protocols for these species. We recommend that MDC Smallmouth Bass managers consider the following modifications to current sampling protocols:

1. *Sample in water temperatures between 18 and 28 ˚C.*
2. *Follow the American Fisheries Society recommended power goal (Miranda 2009; Appendix 50). It may be possible to reduce power settings (20% below median target power) if conducting boat electrofishing in areas containing electrofishing-sensitive species.*
3. *Consider potential depth limitations of electrofishing and avoid selecting sites that contain long, deep pools (e.g., mean depth > 1 m). At 0.9 m depth, only 30% of the electrical field with field intensities sufficient to elicit immobilization remained, relative to 0.5 m.*

4. *Consider size selectivity in electrofishing samples when making decisions based on relative abundance or size- and age-structure. Our results suggest that capture probability increased with fish size.*

Nebraska

- No report

Ohio

- No Report

Wisconsin

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

Submitted by Zach Feiner, UW-Madison and WDNR

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.

WDNR Panfish Team research update

Submitted by Alex Latzka, WDNR

Over the past year, 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, 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.

Panfish Team members have continued to conduct and publish research on long-term patterns in panfish populations and angler effort, catch, and harvest in Wisconsin. Using 30 years of combined fishery-independent and -dependent data, we found substantial hyperstability between panfish population densities and angler catch rates, and long-term stability in centrarchid catch rates (Feiner et al. 2020 Fisheries Research). We also found only weak or no relationships between standard bag limits (50, 25 and 10) and angler catch and harvest rates, although release rates were highest and total harvest was lowest under more restrictive regulations (Feiner et al *in press,* AFS Symposium). Finally, we also completed analyses of creel data from the 2018-19 ice-fishing season when we asked anglers about their use of electronic aids (e.g., online forums and maps, and on-the-water devices like sonar and cameras). We found 80% of panfish anglers in our study used electronics, and that electronics use was associated with 30-300% higher panfish catch rates (Feiner et al 2020 Fisheries).

In addition to the analyses of experimental regulations, our next projects include (1) developing metrics to characterize panfish populations with stunted or over-harvested size structures that are and resilient or vulnerable to high harvest, and (2) better understanding angler responses to and preferences for panfish angling opportunities in a warming climate, focusing on bluegill anglers.

Ice angling catch and release mortality of bluegills

Submitted by Zach Feiner, UW-Madison and WDNR

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 an antenna array on a small lake in southern Wisconsin, to track their movements and survival post-release. Fishing will occur on multiple days to capture a range of air temperatures, fish

sizes, and handling times. Sampling will occur during the winter of 2020-2021 and results will be reported as they become available.

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

Submitted by Ethan Brandt, University of Wisconsin-Stevens Point

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 are related to walleye recruitment history. 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.

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

Submitted by Camille Mosley[1], Stuart Jones[1], Chris Solomon[2], Stephanie Shaw[3], and Greg Sass[3]

University of Notre Dame[1], Cary Institute of Ecosystems Studies[2], Wisconsin DNR[3], Rainbo Lodge, Inc.

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.

Centrarchid removal project

Submitted by Giancarlo Coppola, UW-Stevens Point

The Center for Limnology at UW-Madison, the Wisconsin Cooperative Fishery Research Unit at UW-Stevens Point, and the WDNR completed their third year (2018-2020) of experimental removals of centrarchids in McDermott Lake, WI, to assess their impact 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. During the 2020 field season, approximately 42,000 individuals have been removed belonging to black crappie, bluegill, largemouth bass, pumpkinseed, and rock bass, making the total >225,000 removed since 2018. There has been no evidence of natural walleye recruitment throughout the study period. Since the removal began, adult relative abundance of some centrarchid species (black crappie and largemouth bass) have declined while others (bluegill and pumpkinseed) have remained unchanged. We will continue to monitor the lake ecosystem in 2021 and will provide results once they become available.

Smallmouth bass population genetic structure

Submitted by Peter Euclide, UW-Stevens Point

UW-Stevens Point, WDNR, USGS, and Michigan DNR collaborated on a project to understand smallmouth bass genetic population structure across 32 sites in the Upper Mississippi River and Lake Michigan watersheds. Smallmouth bass were genetically distinct between these major basins. There was further subdivision of genetic strains into 2-6 distinct units in the Lake

Michigan watershed delineated by habitat types (rivers or lakes), and 2-9 units in the Mississippi watershed that were generally delineated by watershed boundaries, suggesting low gene flow among these subpopulations. A manuscript detailing these results (Euclide et al., 2020) was published in Transactions of the American Fisheries Society.