North Central Division American Fisheries Society

Centrarchid Technical Committee

2022 Annual Report

The Centrarchid Technical Committee (CTC) held quarterly meetings in 2022. The Joint CTC/ETC/WTC meeting was held at the Iowa Lakeside Laboratory in Milford, IA July 18-20, 2022. Any questions can be directed to Will Radigan at wradigan2@huskers.unl.edu or to the state representatives below.

State Updates

Iowa (State Rep: Mike Weber)

Seth Fopma: A brief update from the Mississippi

Iowa DNR staff continue to monitor centrarchid populations in Pool 12 backwaters following the completion of the Pool 12 Overwintering HREP project. Crews have been sampling fish in 8 backwaters (4 project and 4 control) to assess potential impacts of habitat manipulations (~63 acres of dredging and flow control structures) directed to increase overwinter survival of centrarchids. Project monitoring was initiated in 2006 with construction occurring 2014-2017, monitoring will cease in 2028. Monitoring consists of conducting pre-ice (water temperatures <10 C) Fyke-netting (5 net-nights/ backwater). Aging structures are also collected from a subset of Bluegill (10/10mm bin) are kept in each lake annually. To date 31,801 Bluegill have been collected through sampling efforts with 9,274 fish kept for aging. Preliminary results indicate significant increases in Bluegill, White Crappie, and Black Crappie mean length (Pre- vs. Post-construction). Increases in quality-plus abundance has also been noted for the aforementioned species in project lakes following construction completion. Continued monitoring will include collection of aging structures from additional species.

Bryan Hayes: Largemouth Bass population assessment

Recent work on Brushy Creek indicated angling mortality was relatively low, especially for recreational (2.8%) and initial tournament mortality (0.4%). While delayed tournament mortality made up the largest proportion of fishing mortality (5.5%), it was still ten times less than that of natural mortality (57%). Thus, cumulative angling mortality likely has little effect on bass in Brushy Creek and many other bass populations. We are currently conducting a Bass population assessments on fifteen to twenty lakes throughout Iowa over the next two years to evaluate variation in population dynamics among systems. This will build on work completed at Brush Creek and also the work being done by Research Biologist Jonathan Meerbeek on Bass in the natural lakes. To date, spines have been collected, processed, and aged structures from Big Creek, Twelve-Mile, Green Valley, Little River, Lake Anita, Prairie Rose, and Viking for this project.

Illinois (State Rep: Andrya Whitten)

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

Nerissa McClelland, Illinois Department of Natural Resources

In 2022, the IDNR State Fish Hatchery System stocked over 82,000 black crappie measuring 2" into the Starved Rock Pool of the Illinois River.

University Research:

Allison Hay, University of Illinois Urbana-champaign

My project is concerned with how different elements of competitive fishing tournaments impact aspects of largemouth bass behavior and survival. This project will primarily focus on the long-term movement, habitat association, and thermal ecology of bass following release at a common location via acoustic telemetry data. Additionally, this project will include a lab -controlled simulation of live well containment reflective of field collected data to determine the impact of livewell containment during a tournament. Lastly, it is planned to quantify short term movement following release in a new tournament format of catch-weigh-release tournaments. Only preliminary data has been collected on this project, but site visits, planning, and stakeholder interaction are well underway.

Nebraska (State Rep: Sean Farrier)

Comparing Bluegill Growth Between New and Established Flood-Control Reservoirs in Southeastern Nebraska

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

The Nebraska Game and Parks Commission (NGPC) has actively managed flood-control reservoirs in southeastern Nebraska for Bluegill *Lepomis machrochirus,* along with other warmwater fish species (*i.e.* Largemouth Bass *Micropterus salmoides*, Channel Catfish *Ictalurus punctatus*, and Black Crappie *Pomoxis nigromaculatus*). New flood-control reservoirs are being constructed in southeastern Nebraska, with plans for additional reservoirs in the future. This situation created the opportunity to evaluate Bluegill growth between newly constructed and/or renovated reservoirs and established reservoirs at a different trophic state. This study analyzed Bluegill growth data from eight different flood-control reservoirs (four newly impounded or renovated, and four established reservoirs) in southeastern Nebraska in 2021 and 2022 to determine differences in Bluegill growth among reservoirs and reservoir types (*i.e.* established or new). The study will (1) test the current perception that Bluegill grow faster in new flood-control reservoirs then in established reservoirs and (2) further depict aging precision and biases related to Bluegill scales and otoliths. Preliminary results show percent agreement for otoliths was 88.5% for consensus age and 99.5% within one year for all collected Bluegill during the study. Percent agreement for consensus age using scales was 51.6% and 88.2% within one year. Based on these results and a multitude of other published literature, otolith ages were utilized as the consensus age when calculating mean length at age among reservoirs in the study. The mean length at age for Bluegill between the established reservoirs and new reservoirs was greater for the new reservoirs for ages 3 ($T = -2.491$, $P = .0136$) and 4 ($T = -4.997$, $P < .001$). Mean length for age-3 Bluegills from established reservoirs was 147.687 ± 3.273 and 157.418 ± 2.290 for newly renovated reservoirs; age-4 Bluegills was also different between established (168.687 ± 3.779) and new reservoirs (194.682 ± 1.790). Continued analysis of this project will ensue as well as future professional presentations and a peer-reviewed journal article acceptance.

Efficacy of Novel Maximum Length Limits on Panfish to Promote a Trophy Fishery for Panfish in Southeast Nebraska
Jake Werner, Aaron Blank, Jehnsen Lebsock, and Matthew Perrion

Flanagan Lake is a 220-acre flood-control reservoir located in Elkhorn, Nebraska (northwest Omaha) that opened to the public in 2018. Prior to opening, the lake was stocked with Largemouth Bass (*Micropterus salmoides*), Black Crappie (*Pomoxis nigromaculatus*), Bluegill (*Lepomis macrochirus*), Redear Sunfish (*Lepomis microlophus*), Channel Catfish (*Ictalurus punctatus*), and Northern Pike (*Esox lucius*). From 2018 through 2022 the fishery was managed with a catch and release regulation on all fish to allow the fishery to develop while a new management plan was developed. Traditionally, panfish (i.e., Redear Sunfish, Bluegill, and crappie) in southeast Nebraska have been managed through creel limits or creel limits in conjunction with minimum length limits on crappie in some waterbodies. The later has been implemented infrequently with limited or no success in increasing the number of preferred length crappie. In many southeast Nebraska waterbodies, the panfish fisheries are high density fisheries that tend to hit growth bottle necks (8-10 inches for crappie and 6-8 inches for Bluegill and Redear Sunfish) with few individuals growing beyond these lengths. Waterbodies that don't exhibit high density fisheries tend to have better growth and a high proportion of preferred length panfish. Therefore, in an attempt to create a trophy fishery for panfish, a 10-inch maximum length limit on crappie, an 8-inch maximum length limit on Bluegill and Redear Sunfish, a 21-inch minimum length limit on Largemouth Bass, and a catch a release regulation for Northern Pike was implemented on January 1st, 2023. The goal of these regulations is to reduce the density of sub-preferred length panfish in order to increase growth rates of the remaining panfish while also keeping larger, fast-growing individuals in the population to propagate. These regulations will be evaluated for the next five years using catch rates, growths rates, and size structure as indices of regulation impact. These indices will also be compared to the panfish population in a neighboring reservoir with similar structure, water quality, and species composition.

Assessing Reader Precision among Scales, Sagittal Otoliths, Dorsal Fin Spines, and Anal Fin Spines of Largemouth Bass in Southeastern Nebraska Flood-Control Reservoirs
Jake Werner, Aaron Blank, Jehnsen Lebsock, and Matthew Perrion

Effective management of freshwater sportfish populations often relies on the ability to assess recruitment, growth, and mortality. Proper age estimation of fishes is required to calculate accurate dynamic rate functions and is often done through the collection or extraction of hard structures from the fish. Traditionally, age estimations for Micropterus spp. were conducted using scales, but current research has found scale ages demonstrate inaccuracies. Additional research has documented sectioned sagittal otoliths as the most accurate and precise structure for age estimation, particularly for older fish. However, sacrificing fish for age, growth, and mortality analysis in certain water bodies is not always feasible or desired. Thus, we assessed reader agreement and reader precision among scales, anal fin spines, dorsal fin spines, whole-viewed sagittal otoliths, and sectioned sagittal otoliths. We collected Largemouth Bass (*Micropterus salmoides*) from nine different southeastern Nebraska flood-control reservoirs during standardized spring nighttime boat electrofishing surveys. All spines, sectioned, and whole otoliths were viewed under a microscope while scales were viewed using a microfiche reader. Ages were assigned to all structures by four different readers, two were experienced (> 5 years of experience) and two were inexperienced (< 5 years of experience). Reader agreement and bias was analyzed for both experienced and inexperienced readers. Consensus ages were agreed upon by all four readers for only the sectioned otoliths because this structure was used as our standard to assess aging bias from the other structures.

Preliminary results indicate percent reader agreement was the highest for sectioned otoliths for both experienced and inexperienced readers. Surprisingly, reader agreement for non-lethal aging structures was highest for scales (Table 1). All readers tended to overestimate ages on young fish and underestimate ages for older fish. The inflection point varied for each aging structure but appears to remain consistent between experienced and inexperienced readers (Figure 1).

A larger analysis will be available soon, but preliminary results indicate scales may be the best non-lethal aging structure for Largemouth Bass in southeast Nebraska. However, our lighting apparatus was not adequate for capturing the clearest images and recent improvements in methodology seem to be better at illuminating annuli in both anal fin and dorsal fin spines. We are planning on recapturing images from anal fin and dorsal fin spines using the new lighting method and repeating the study to see if there are any improvements in reader agreement and bias.

Table 1: Percent reader agreement (% Agreement) and mean coefficient of variation (CV) for each structure collected for both experienced and inexperienced readers. Valid N is the number of individual fish that all readers were able to estimate an age on any given structure.

		Experienced		Inexperienced	
Structure	Valid N	% Agreement	CV	% Agreement	CV
Sectioned Otolith	149	77.85 %	8.02	55.7 %	25.89
Whole Otolith	149	55.7 %	13.16	36.91 %	24.96
Dorsal Spine	143	23.78 %	25.47	8.22 %	43.99
Anal Spine	137	21.9 %	28.31	20.59 %	33.38
Scales	148	45.27 %	14.13	41.89 %	15.97

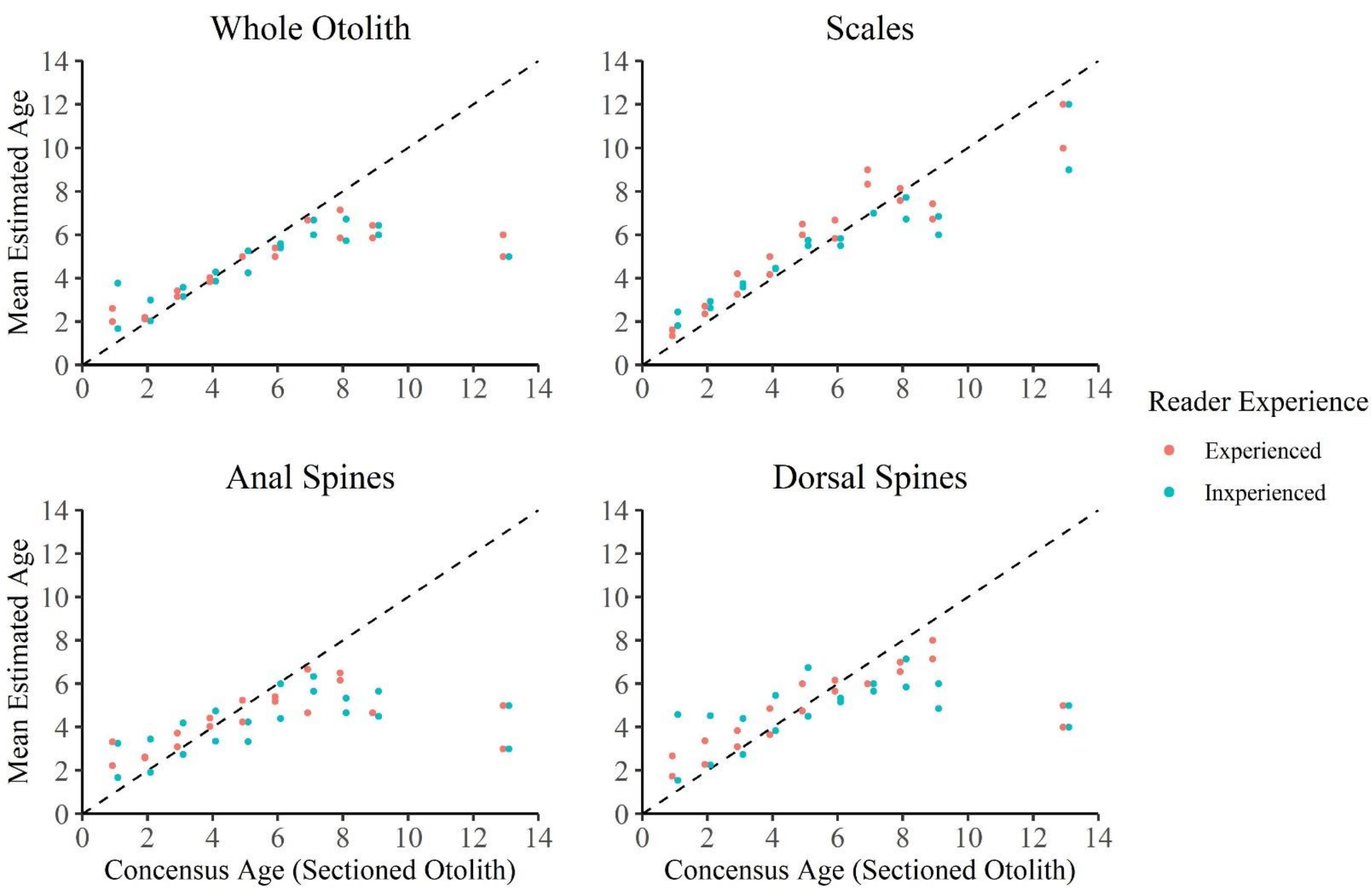


Figure 1: Age bias plots for whole-viewed sagittal otoliths, scales, anal fin spines, and dorsal fin spines in comparison to consensus ages from sectioned sagittal otoliths. Each point on a given

plot represents the mean age that particular reader assigned fish that were determined to be age *x* based off sectioned otolith estimates.

Michigan (State Rep: Matt Diana)

Update on Michigan DNR Bass Management Committee

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 met for the first time in May and has begun drafting specific objectives and goals as well as terms of reference. The committee plans to review current management for black bass in Michigan and review existing regulations. This is a first step towards more active management for Largemouth and Smallmouth Bass by the agency.

Panfish Management Evaluation Update

The panfish group has drafted an angler survey which will be released to the public shortly. This survey aims to assess angler attitudes about harvest and interest in quality panfish management. Anglers are asked to comment on proposed regulations that could be utilized on a subset of lakes in an experimental assessment. The workgroup will summarize survey results and design experimental implementation of regulations based on results of the survey. The workgroup will provide a report summarizing the survey

DNR and EGLE workgroup on Aquatic Nuisance Species Control

DNR and EGLE ANC have been meeting for the past 3 years to review chemical treatment permit to determine when additional restrictions are warranted. The workgroup recently implemented new seasonal restrictions of copper and chelated copper treatments during centrarchid spawning. The new restriction will not allow for any use of copper sulfate prior to July 1 and limits the amount of the littoral zone that can be treated with chelated copper prior to July 1. Copper products have demonstrated impacts on fish movement and when applied to spawning areas can result in increased nest abandonment potentially impacting recruitment. Copper can also impact larval fish as they are sensitive to local environmental quality changes that can result from chemical treatments. EGLE permits for ANC are issued on a three-year rotation and restrictions will be implemented on new permits while they are issued.

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. Initial finding shows more movement between these systems than expected indicating that it may be more appropriate to manage the fishery as one population. Currently Beaver Island has a delayed season opener (July 1) due to recruitment concerns.

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.

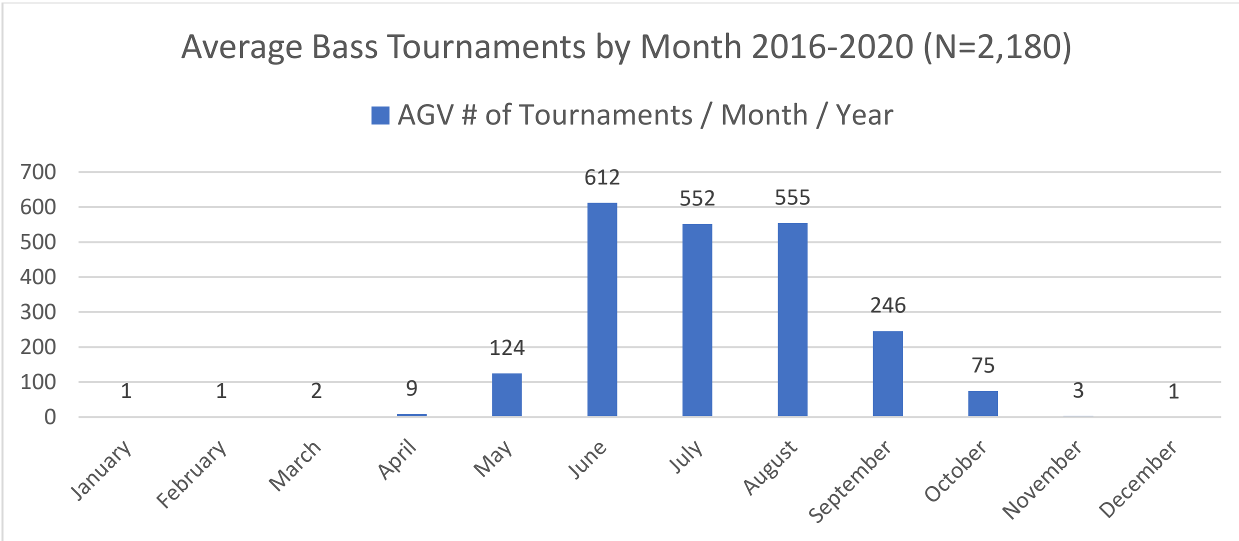
Objectives for the project are to 1) develop a model that describes fishing tournament patterns in Michigan; 2) determine if bass population demographics differ among lakes with differing fishing tournament pressure; and 3) determine if bass population demographics differ before and after the CIR regulation 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.

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.

<u>2016-2020 Bass Fishing Tournament Information System Statistics</u>

- 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.



Missouri (State Rep: Cade Lyon)

Assessing the Effects of Length Limit Regulations on the Mark Twain Lake Crappie Fishery

Contact Information:

Name: Annie Hentschke
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Phone: 573-248-2530 x6388

Objectives:
1) To determine angler exploitation of crappie in Mark Twain Lake.
2) To determine if new harvest regulations would improve the size structure of crappie in Mark Twain Lake.

Status: *Ongoing*

Abbreviated Abstract: The Missouri Department of Conservation (MDC) completed tagging of 1,000 crappie in 2019 and 1,000 crappie in 2021 for the two-year assessment of crappie exploitation in Mark Twain Lake. Tagging efforts were put on hold in 2020 due to USACE boat closures from COVID-19. Crappie at least 8 inches long were tagged with individually numbered Carlin-dangler tags under the spiny dorsal fin. To encourage anglers to return capture information, tags were inscribed with a $25 or $75 reward and local contact information. Preliminary results from 2019 tag-recovery data indicated an exploitation estimate of 29 percent for both species combined (includes adjustments for handling mortality, tag retention, non-

reporting, etc.). Simulation modeling for white crappie indicated that growth overfishing is not occurring, and a 9-inch minimum length limit would decrease yield. Tag-recovery data from 2021 continues to be collected and a full assessment will be made after April 2022.

Smithville Lake crappie regulation change

Submitted by Eric Dennis (Eric.Dennis@mdc.mo.gov)

The length and creel limits for crappie were changed at Smithville Lake in 2019. The old regulation was 15 crappie daily limit with a 9” minimum length limit. In 2019 it was changed to a 30 fish daily creel but may include not more than fifteen (15) fish more than nine inches (9”) in total length. The thought process behind this regulation was that slow growing black crappie were not reaching nine inches in their lifetime, but white crappie grew well. The average RSD(9) for the last 25 years was 2.1 and this value increased significantly following this regulation change.

Crappie (Black)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Effort (TN days)	40	39	48	40	42	53	42	35	56	56	56	47	56	56	54	42	48		40	28	28	30	40	40	40
CPUE-TN (>5"/NN)	7.4	5.3	3.0	7.9	9.8	9.04	11.67	34.54	17.33	31.38	17.82	22.6	14.59	66.59	40.17	15.12	23.1		35.6	35.6	23.9	25.6	21.6	21.5	27.1
PSD (8)	5.15	5.85	4.86	28.89	37.2	18.32	23.69	22.7	12.34	10.13	27.26	18.59	15.69	26	10	29.13	35.16		25.1	44.9	35.3	28.7	66.3	22.9	45.7
RSD (9)	0	0	1.39	0	0.49	0	0.21	0.51	0.21	0.24	0.12	3.43	1.35	2.2	4.55	5.63	4.7		8.9	4.1	4.4	2.1	39.2	13.5	12.2
RSD (10)	0	0	0	0	0	0	0	0	0.11	0	0	0.57	0	0.35	0.64	0.78	0.22		2.5	0.4	1.2	0.8	7.1	6.4	1.7
RSD (12)																			0.3	0	0	0	0.6	0.2	0

Evaluation of the bonus fishery created by the low-density stocking of Striped Bass (*Morone saxatilis*) in Bull Shoals Lake

Submitted by Andy Turner (Andy.Turner@mdc.mo.gov)

In 2013, the Missouri Department of Conservation started a biennial stocking (16,000 fingerlings, 0.36 fish/acre) of Striped Bass in Bull Shoals Lake. This stocking plan, which will be reevaluated following completion of this research project, aims to produce a high-quality and low-density bonus fishery to supplement current angling opportunities. This project will evaluate the outcome of this stocking plan to define success and provide the information needed to make future management and stocking decisions based on sound science. Main goals of this research include 1) defining the population dynamics and movement information needed to inform management discussions and 2) evaluate the overlap in diet of Striped Bass and other sport fish in the reservoir. Data collection for this project is ongoing but will be completed in the summer of 2022.

Lake Wappapello White Bass Management Evaluation

Submitted by Dave Knuth (Dave.Knuth@mdc.mo.gov)

In response to angler concerns, the population dynamic rate functions, exploitation, and the variables influencing recruitment of white bass, *Morone chrysops*, in Wappapello Lake were evaluated to develop objectives and management strategies to produce a more sustainable fishery. The main findings following the first two years of the study are listed below.

- Experimental gill-net and electrofishing catch rates were very low indicating low population abundance. Gill-net CPUE values ranged from 0.0139-0.0951 fish/h in 2018 and 2019, respectively. Electrofishing CPUE values ranged from 2.86-8.47 fish/h in 2019 and 2020, respectively.
- The white bass population exhibited a skewed age distribution and increased longevity. Over 90% of the fish were younger than age-3 during the first year (2018-2019), and younger than age-4 during the second year (2019-2020). The oldest fish collected was age-13 and multiple missing year classes were observed.
- Growth of white bass was rapid and sex dependent differences in growth were observed. On average both sexes reached preferred lengths (300 mm) in 2 years, and nearly reached memorable lengths (380 mm) in 3 years. After age-1 females grew faster than males in both length and weight.
- White bass matured rapidly, with males achieving full maturity by age-2, and females by age-3.
- Relative weight (W_r) values were higher during the fall than the spring, and were highest for memorable-trophy size fish, but lowest for stock-quality size fish.
- Annual adjusted exploitation estimates were low to moderate during both years of the study, and ranged from 4-5% at 2-20% tag loss during 2019, and 20-25% at 2-20% tag loss during 2020.
- Total annual mortality was 37% and natural mortality was low for this species ranging from 12-17% at higher ranges of exploitation and 32-33% at lower ranges of exploitation.

- Recruitment was highly inconsistent to non-existent some years and was related to the change in, or stability of river stage during April and May. This suggests the population is largely driven by patterns of recruitment and year-class production, and overharvest is not a major limiting factor. Consequently, length based regulations will likely be only marginally successful, and management techniques designed to improve recruitment have the best potential of improving the white bass fishery at Wappapello Lake.

The white bass management evaluation was continued during 2021. Results from data collected will be analyzed in spring 2022.

Status of NWMO lakes post-predator study

Submitted by Matt Engel (matthew.engel@mdc.mo.gov)

The predator study involved stocking hybrid striped bass and flathead catfish into impoundments in NW Missouri to increase predation on Gizzard Shad and reducing competition

Observationally, we are seeing a centrarchid response to hybrid striped bass stockings in a few of the predator study lakes that ended a few years ago. During the study, Michaletz did not document any significant changes; however, since the end of the study, crappie spp. In Limpp Lake (30 acres), and bluegill and crappie spp. In Nodaway Community Lake have transformed from stunted populations to good fisheries in spite of the presence of gizzard shad. We have seen an increase in angler use and harvest on the crappie population at Limpp. Once the crappie shifted from 6-8" to 10-14", word got out quickly. On Nodaway, we are seeing more pressure than before the study as well. The hybrids themselves have become popular there along with the crappie. The bluegill have been less utilized. Nodaway is 73 acres. Willow Brook (130 acres), Hamilton (85 acres), and Little Compton (40 acres) have shown much less of a change to this point, but Willow Brook and Hamilton have developed into the best hybrid fisheries, which has increased angler use on those lakes as well.

South Dakota (State Rep: Elizabeth Renner)

Report from Brian Blackwell

2022 Bluegill Summary
Angler exploitation
Enemy Swim 2022

- Bluegill population estimated at 20,713 fish ≥6 inches
- 1,000 bluegills tagged (850 non-reward and 150 reward)
- Few Bluegills were reported by anglers in 2022

- 2.0% of 2022 reward-tagged fish reported as harvested through December 2022

- 0.4% of 2022 non-reward tagged fish reported as harvested through December 2022

Clear Lake 2022

- Bluegill population estimated at 189,889 fish ≥6 inches

- 1,000 bluegills tagged (850 non-reward and 100 reward)

- Few Bluegills were reported by anglers in 2022

- 1.0% of 2022 reward-tagged fish reported as harvested through December 2022

- 0.5% of 2022 non-reward tagged fish reported as harvested through December 2022

Developed bluegill growth parameters for the months of June, July, and August from east river Bluegill population samples (2010-2022). Values can be used to compare growth across populations since otoliths are now the preferred age estimating structure and we do not currently back calculate from otoliths. Values C50 represent 25th (slow growth) and 75th (fast growth) percentiles and values between these would be considered average growth. N = populations included.

		Total length (mm) at capture at age								
Month	Parameter	1	2	3	4	5	6	7	8	9
June	N	11	19	18	20	18	7	5	3	3
	Mean (SE)	93 (4)	121 (4)	145 (6)	164 (6)	181 (6)	203 (7)	197 (7)	214 (14)	213 (13)
	Median	90	125	145	163	181	203	193	209	203
	C50	80-106	105-137	129-162	138-190	164-197	189-217	188-206	196-232	198-228
July	N	10	13	12	13	10	3	2	2	2
	Mean (SE)	101 (6)	139 (8)	163 (8)	183 (6)	193 (5)	215 (7)	214 (1)	223 (4)	232 (9)
	Median	94	131	168	181	199	214	214	223	232
	C50	88-114	114-164	148-179	171-195	181-206	206-224	213-214	219-226	223-240
August	N	5	6	6	6	4	1	1		
	Mean (SE)	111 (3)	149 (5)	174 (4)	186 (10)	183 (14)	220	222		
	Median	103	149	174	186	189	220	222		
	C50	106-115	140-158	166-181	177-195	163-203	220	222		

Report from Dakota AFS abstracts

The Devils Lake White Bass Population.

Todd Caspers and Randy Hiltner, *North Dakota Game and Fish Department, Devils Lake, ND*

Devils Lake is one of North Dakota's most important fisheries. Devils Lake is the 3rd largest waterbody overall and is the largest natural lake in the state. In 1992, the North Dakota Game and Fish Department began more intensive netting surveys on Devils Lake. Shortly afterwards, a prolonged period of wetter climatic conditions caused Devils Lake to grow greatly in size and depth. In turn, anglers now spend over 1 million angler-hours on the lake and spend 50 million dollars or more per year in the local economy. White bass were stocked in the lake one time in 1971 to provide a sportfish that could tolerate the higher salinity levels at the time. White bass gained a foothold in the lake from that stocking and have reproduced naturally since that time. White bass recruitment in the lake is sporadic but can produce "bass booms" when recruitment is strong. White bass are a secondary sportfish in the lake and most anglers do not target them. However, Hmong anglers prefer white bass and target them from the shoreline. The year-class produced in 2015 was likely the strongest to date and produced a "bass boom". This year-class has been tracked through time to provide an estimate of growth and mortality. The initial mortality estimate produced a total annual mortality of 12%, which is low and indicates that neither natural nor fishing mortality is excessive

Diet and Habitat Overlap Between Sport Fishes in a South Dakota Glacial Lake

Lauren Allex*[1], Logan Cutler[1], Brian Blackwell[2], and Alison Coulter[1], [1]South Dakota State University, Brookings, SD, [2]South Dakota Game, Fish, and Parks, Webster, SD

In northern U.S. lakes, Walleye (Sander vitreus) have potential to compete and overlap in their habitat use and diets with other fishes including Northern Pike (Esox lucius) and Smallmouth Bass (Micropterus dolomieu). We examined the potential competition of these species in Lake Kampeska, South Dakota, a lake with native Northern Pike and Walleye populations and where a Smallmouth Bass population was introduced in the late 1980s. Lake Kampeska has a watershed area of 20,433 acres, a surface area of 5,250 acres, and is partially connected to a stretch of shallow open water wetlands via a weir that allows for some fish movement between the habitats. Our objective was to determine the amount of potential competition among Walleye, Northern Pike, and Smallmouth Bass and examine how potential competition may vary between habitats (lake vs. wetland) and across seasons. We completed our objective using two approaches. Our first approach was to use direct stomach content analysis. The second approach was to examine carbon and nitrogen stable isotope ratios from muscle samples. We used boat electrofishing and gill nets to collect the fish seasonally from summer 2021 - summer 2022. Over the study period, we collected 149 Walleye, 114 Northern Pike, and 99 Smallmouth Bass. Smallmouth Bass diets were mainly dominated by crayfish (Faxonius virilis), while Northern Pike and Walleye diets were largely prey fish. Although each species ate some prey fish, the most important prey fish species varied between predator species. Isotopes also suggested Walleye utilize different resources than Northern Pike and Smallmouth Bass. Seasonal variation in diets was present and diets also tended to differ by at least 50% within each species between the lake and the wetland. We determined that due to minimal overlap and abundant resources, competition is likely limited in both habitats.

Spatial and Seasonal Variation in Sportfish Length-Frequency and Relative Weight

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Small impoundments (<150 ha) provide important recreational fishing opportunities in eastern South Dakota. Many of these impoundments experience seasonal hypoxia in part due to excess nutrient run off. The effects of hypoxia on sportfish communities in small impoundments are not widely known, but previous research has documented changes in habitat quality and invertebrate communities that could impact fisheries. We examined the extent and the effects of hypoxia on Largemouth Bass (Micropterus salmoides) in two small impoundments, lakes Alvin and Marindahl, in southeastern South Dakota. Lakes were divided into three zones:

a lacustrine zone near the dam, a transitional zone, and a riverine zone near the inflow. Largemouth Bass were collected by electrofishing in summer (hypoxia present) and fall (hypoxia reduced) of 2022 with 3-15 min transects per zone. Total length (mm) and weight (g) were measured for each fish. Water temperature and dissolved oxygen profiles were collected along transects within each zone and will be used to map the spatial extent of hypoxia. For each zone and season, length-frequency and relative weight of Largemouth Bass were quantified. We present initial results from this study which will continue through 2025. Results will inform future management of small impoundments in the Dakotas.

Ohio (State Rep: Steve Tyszko)

The Ohio Department of Natural Resources, Division of Wildlife (ODNR-DOW) continues to fund PhD student Rachael Finigan at The Ohio State University who is investigating differences in population characteristics and genetics among Largemouth Bass populations in reservoir across Ohio. The work is scheduled to be completed in 2024.

ODNR-DOW continues to monitor crappie populations in a set of 13 reservoirs where a 9-in minimum length limit was recently removed.

Wisconsin (State Rep: Zach Feiner)

WDNR Panfish Team Update

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

Experimental Regulations Project

The Wisconsin DNR Panfish Team has been preparing for the first evaluation at the halfway point of our statewide 10-year experimental panfish (including sunfish and yellow perch) regulations. This project implemented new restrictive regulations (1. 25-bag with no more than 10 of any species, 2. 15-bag with no more than 5 of any species during May and June, and 25-bag the rest of the year, and 3. 15-bag with no more than 5 of any species) on a total of approximately 100 lakes across the state, and we have been conducting spring fyke netting and electrofishing to track changes in bluegill, black crappie, and yellow perch density and size structure. In 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.).

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

Submitted by Dan Dembkowski (UWSP)

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

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

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

In the upper Midwest, ongoing climate change may have significant effects on the dynamics and demographics of bluegill populations. Changes in bluegill populations will likely translate to changes in bluegill fishing opportunities and angler utilization of these fisheries, leading to potential changes in management philosophies and strategies. The objectives of this study are to determine if a suite of abiotic and biotic factors explain spatial variation in bluegill growth and size structure across the Midwestern USA and while also providing fishery managers within the region with standards for categorizing bluegill populations based on growth and size structure. Data analysis is ongoing and initial results will be presented at the Midwest Fish and Wildlife Meeting in 2023.

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 were be performed by UW-Madison and WDNR staff in winter and summer 2021-2022 on a subset of lakes in northern and southern Wisconsin. Initial results and workplan were presented at the Wisconsin Chapter AFS meeting in 2023.

Centrarchid population responses to intensive removal in a northern Wisconsin lake

Submitted by Dan Dembkowski (UWSP)

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

Largemouth and Smallmouth Bass

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

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

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

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.

Fisheries Management

Climate change effects and RAD adaptation strategies in Wisconsin fisheries

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

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

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 in review at Fisheries.

Black crappie influences on walleye natural recruitment in northern Wisconsin lakes

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

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

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

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

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

Seasonal variation in angler catch rates of Wisconsin anglers

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

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

<u>Fish-Vegetation Relationships in Lakes</u>

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

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

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

Kansas (State Rep: Seth Lundgren)

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. Onethousand 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 9 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