North Central Division of the American
Fisheries Society

Joint Winter Business Meeting of the
Centrarchid, Esocid, and Walleye
Technical Committees

4:00 – 6:00 PM CST, Sunday, January 19,
2025
In association with the Midwest Fish & Wildlife Conference (St. Louis, MO); Sterling 3 (2nd Floor)
Join the meeting now
Meeting ID: 217 039 249 377
Passcode: zu7ye6P5

WTC Chair: Jason Gostiaux,
gostiauxj@michigan.gov WTC Chair-
elect: Aaron Voirol,
AVoirol@dnr.IN.gov
WTC Immediate past-chair: Logan Zebro,
Logan.Zebro@sdstate.edu WTC Secretary: Joe Rydell,
joe.rydell@nebraska.gov
ETC Chair: DJ Loken,
Daniel.Loken@mdc.mo.gov CTC
Chair: Will Radigan,
wradigan2@huskers.unl.edu

1. **Call meeting to order**

Due to technical difficulties with the projector and computer connection the meeting was called to order a few minutes late at 4:12pm CT and began with introductions. A sign-in sheet was passed around the room.

a. Introductions

34 participants attended in person and 3 virtual. Representatives were from Nebraska, Indiana, Kansas, Missouri, South Dakota, Minnesota, Wisconsin, North Dakota, Iowa, Illinois, and Michigan
Jason Gostiaux determined that a quorum of representation of the technical committee has been met.

2. **Agenda additions and approval**

Jason asked the group if there were any changes to the meeting agenda and announced that no changes were brought forward through email when the agenda was sent out prior to the business meeting. No changes were brought forward.

Since it was determined that there was not a quorum present at the summer meeting, the 2024 winter business meeting minutes still needed to be approved. No changes were proposed to those meeting minutes. Sean Farrier motioned for approval which was 2nd by Melissa Wuellner and approved.

Next the business meeting minutes from the summer meeting were brought forward and no additions or changes were proposed. Sean Farrier motioned for approval which was 2nd by Melissa Wuellner and approved.

3. 2025 Summer Meeting

Jason gave a summary of the plans for the summer meeting in 2025 to be held at Beaver Island on Aug 5-7th, 2025. He mentioned that he was working with the ferry to include it's cost into the registration will help with the logistics of the meeting.

a) Beaver Island, MI
b) Aug 5-Aug 7, 2025
c) Possibly a telemetry workshop for continuing education component; other ideas?
    i. Experimental design
    ii. Data analysis
    iii. Panel discussion

Jason suggested that the telemetry workshop could include participants bringing some of their own data or working through the program that Michigan uses (Great Lakes Acoustic Telemetry Observation System or GLATOS). No discussion was generated so it was decided to go with a training on the GLATOS system.

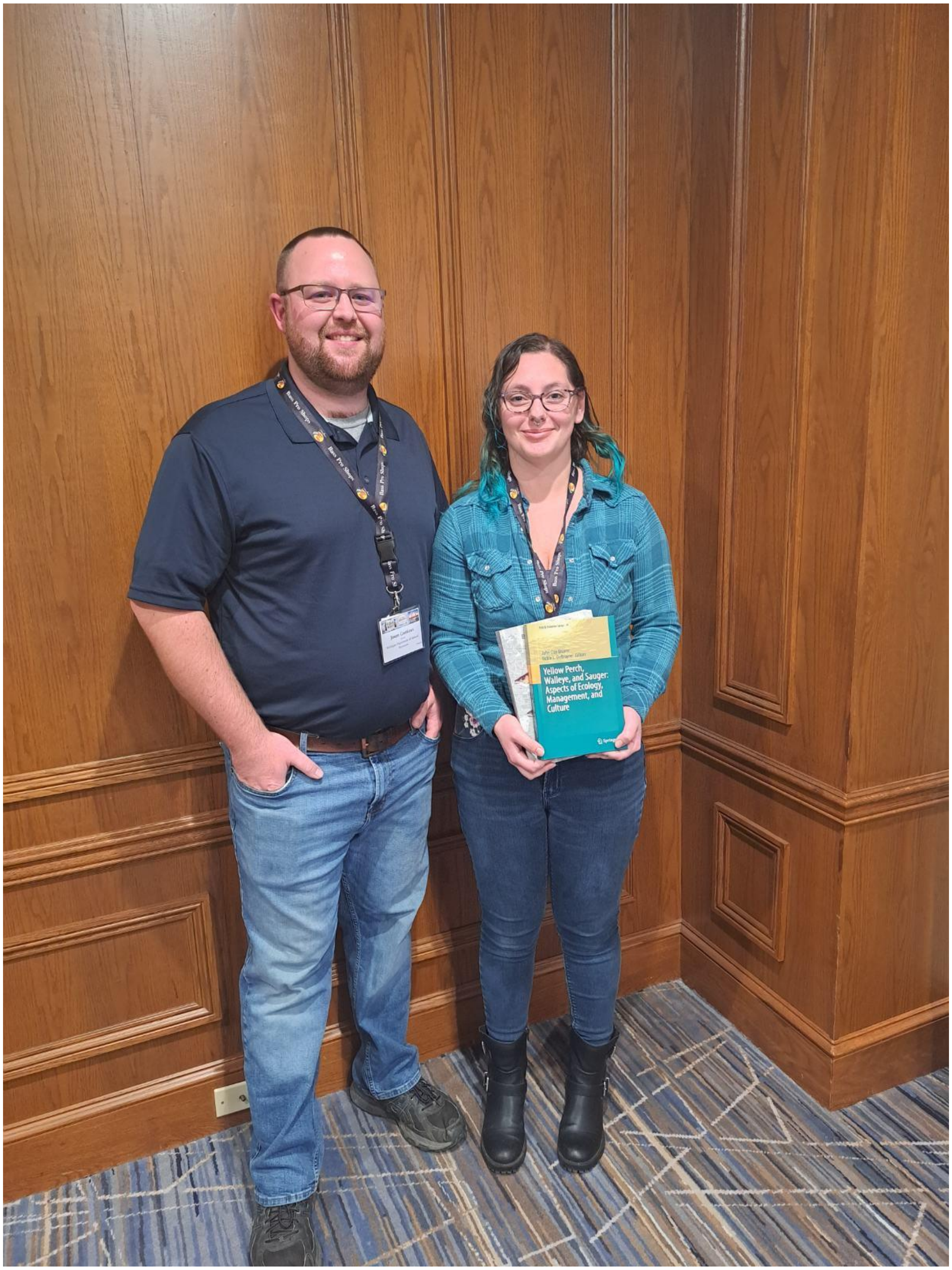
4. Break-out for CTC, ETC, and WTC

5. Percid travel award winners

a) Max Wilkinson – University of Wisconsin-Stevens Point
    i. *Evaluating the distribution of fish community production in northern Wisconsin lakes with different walleye recruitment histories*
        1. Monday January 20, 2025; 3:40pm – 4:00 CST; Regency C
b) Maddy Siller – South Dakota State University

        i. *Addressing the data need to manage future change in fisheries*
            1. Monday January 20, 2025; 4:20 – 4:40 CST; Regency D
        ii. *Assessing habitat quality changes for cool- and warm-water fishes*
            1. Monday January 20, 2025; 4:40 – 5:00 CST; Regency D
    c) Andrew Foley – Ohio State University
        i. *Incorporating long-term fisheries data to understand fish recruitment in a dynamic ecosystem*
            1. Wednesday January 22, 2025; 9:20 – 9:40 CST; Sterling

Jason presented the Percid Awards this year. There were several qualified applicants, but this year's awards went to the three individuals listed above. Max and Maddy were both able to attend the business meeting and were presented with their awards. Each winner won a 300.00 award to help with travel costs to attend the Midwest Fish and Wildlife Conference as well as a copy of the Yellow Perch, Walleye, and Sauger: Aspects of Ecology, Management, and Culture book and a copy of the Biology, Management, and Culture of Walleye and Sauger book. Jason only had one copy on hand of each book but was able to coordinate with the winners later on to get them their check and make sure they all received their books. Each winner's associated state chapter was also asked to match up to 300.00 to the winners as well.



Maddy Siller with Jason Gostiaux.

Max Wilkinson with Jason Gostiaux.

6. WTC state and provincial reports (attached below).

Short summaries of the reports attached below were made by Collin Dassow, Aaron Voirol, Rebecca Krogmann, Todd Caspers, Dylan Graven and Joe Rydell.

Collin started with Wisconsin report.
Walleye stocking has been a little lower than in the past. A big reg change for the state was a bag limit change from 5 fish to a 3 fish bag for the statewide daily bag limit. He reported that there is quite a bit of research available in the final report to review.

Aaron Voirol gave an update on Indiana. He mentioned that a little over 40,000 advanced fingerlings were stocked in 10 lakes, 1 river. The fingerlings averaged under 6 inches. They tried an offsite pond that returned around 4000 fish. Good start for the first year. Stocked 330,000 walleye fingerlings in June. Did some hybrid stockings as well. Biologists did some fall shocking and had about average catch rates. The goal of the shocking was looking for age 1 walleye. Since fall survey numbers are typically low, they were going to do some trap netting in the spring for better results. Last year was the first Walleye online tournament. Brookville reservoir had the best results with the most entries.

Rebbeca Krogmann provided an update for Iowa. Madiline Lewis will be the replacement walleye rep for Iowa. She gave a summary of a report on movement of walleye among a reservoir. Also gave a push for a webinar on modeling through AFS website. Iowa invested a lot into the RAS system and has been plagued by deformities and they appear to be getting worse. They might have had a breakthrough that the feed source may be contributing. Trying a different feed that was not krill-based cut deformities in half. They are still working on this issue.

Todd Caspers, (ND Rep) gave an update on Devils Lake and Stump Lake. Both lakes doing well. About 440 waters provide walleye fisheries in North Dakota. Most lakes are doing well but their potion of Oahe is not doing well for walleye. Habitat problems are the main cause of the decline. State record walleye was broken in 2021.

Dylan G. gave an update on South Dakota. He gave an update on research and hit up the progress to dive into RAS for walleye programs. Blue dog fish hatchery did great on production in 2024.
BJ Shall gave an update on a research project on microchemistry that he will talk about.
Dylan gave an update that Oahe is doing better, and the state record was broke twice in 2024 and although a North Dakota resident had the first record, the current record is back in the hands of a South Dakota angler.

Joe Rydell gave a short update for Nebraska mentioning some production results, highlighted a research project by Will Radigan that was shared with South Dakota, and pointed out the state sampling results that are in the report.

See the complete reports at the end.

7. WTC Treasurer's report by Joe Rydell

a. WTC general/operating fund (expenses, deposits, and balances for calendar year)

The account summary is listed below with more details in the summer meeting report for the summer meeting costs. The account is looking in great shape and a couple things to point out: 1. We received a refund on a double charge from the walleye symposium publication of $2,430.00 that was deposited back into the account. 2. No awards were purchased prior to the winter business meeting for past chair and secretary positions. These awards will be purchased and handed out at the summer meeting at Beaver Island. 3. Mugs were sold at the summer meeting to recognize the location of the meeting, and several mugs are still available that can be purchased by contacting the secretary and any left over mugs will be available at the 2025 summer meeting. In the financial status, it is likely that the WTC will be able to offer 3 more Percid Travel awards for the 2026 Midwest Fish and Wildlife Conference in Indiana.

2025 Winter Business Meeting Summary Treasurer report

Previous 2023 Account Balance	**512.39**
Transfer Money from WTC Investment account	**$2,523.00**
Summer Meeting Income (registration)	**$1,889.00**
Mug sales (at meeting and online)	**$462.01**
Publication refund	**$2,430.00**
Paypal Fees	**$61.20**
Meeting Costs	**$2181.67**
2025 Percid Travel Award	**$900**
Past Chair awards	**$0**
Current Balance	**$4,673.53**

b. WTC AFS Investment Account
   The last update received for the investment account showed good gains in 2023 with a net profit of $1,174.00. The WTC chose to withdraw $2523.00 from the account in May of 2024 that was not reported in the investment program update. This has been brought forward and will be addressed in the next business meeting.

AFS Managed Unit Investment Program

Fund or Unit Name: **Walleye Technical Committee NCD**
For the period ending: 9/30/2024

Contributions	**Date**	**Amount**
Contribution	10/15/2018	$5,000
Contribution	Nov 2019	$2,500

Description	**2021**	**2022**	**2023**	**2024**
Beginning Balance	$9,355	$10,633	$8,848	$10,023
Contributions / Withdrawals	$0	$0	$0	$0
Income	$139	$190	$231	$176
Gains / Loss	$1,188	-$1,927	$979	$1,174
Fees	-$49	-$48	-$36	-$38

Ending Balance	$10,633	$8,848	$10,023	$11,335

- Withdrawal of $2523.00 on May 2024 from the Investment account.

8. **Old business WTC**
   a. Percis VI update (Jason DeBoer)

Jason DeBoer gave an update on Percis VI planning. The meeting was last in Czech Republic around 2022 and typically circulates every 6 to 8 years. Jason has been working with Logan Zebro and Jason Gostiaux, and planning with several others to hold it alongside AFS in Ohio in 2026.

9. **New business WTC**
   a. Approval of new WTC chair Aaron Voirol
   It was announced that Aaron Voirol is the new Chair for the WTC as voted last December as the chair elect. Aaron moves into his new role as chair following the business meeting since he was not able to attend in person. Aaron attended the meeting virtually in 2025.
   b. Officer nominations
      a. Chair-elect

Robert Summerfelt sent an email to nominate Tyler Firkus for chair elect. Jason G. put a nomination in for Joe Rydell to run for chair elect. Todd Casper asked if either or both candidates accepted the nominations. Joe Rydell was hesitant but accepted the nomination. Tyler Firkus was not present, so it was discussed how to proceed. Rebecca Krogman asked about if we can vote online. Mark Fincel said that the NCD would have to approve the chair but normally does. Dan Dembkowski offered that it would be best to contact Tyler online and distribute to the list serve to vote and give it to the NCD ExCom.

      b. Secretary
      Joe Rydell nominated that Dylan Gravenhof be nominated as secretary. Mark Fincel second that nomination. No other nominations were made. Jason G. announced that since the Chair position will announce online, that they will wait and vote as well on the secretary position with Dylan running unopposed.
   c. Conference notes
   Jason G. announced for the group to attend the special symposium and thanked Logan Zebro for his help in setting up the symposium with short notice following the summer meeting.
      a. Special symposium: “Thriving Amidst Challenges: Examining Resilient Walleye Populations”
         i. Wednesday January 22, 2025; 8:00 – 12:00 CST; Regency A
      b. General fisheries track: Walleye

    i. Monday January 20, 2025; 1:20 – 4:40 CST; Regency C

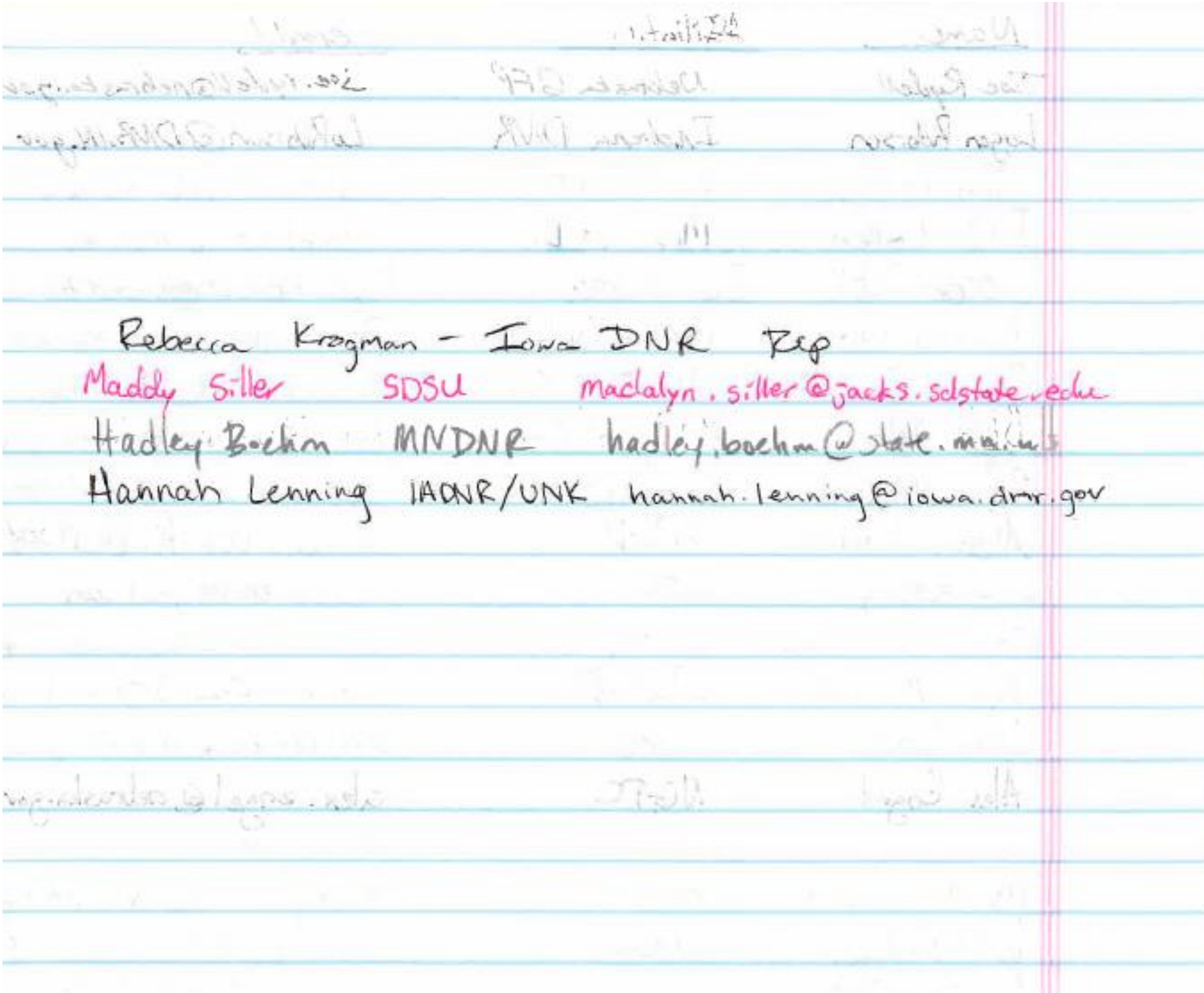
d. 2026 summer meeting locations

10. Adjourn

Jason DeBoer made a motion to adjourn and Rebecca Krogman second the motion. Meeting adjourned at 5:09pm CT.

Attendee list:

Name	Affiliation	email
Joe Rydell	Nebraska GFP	joe.rydell@nebraska.gov
Logan Robison	Indiana DNR	LoRobison@DNR.IN.gov
Jim Mirazga	Kansas KDWP	jim.mirazga@ks.gov
DJ Loken	Missouri DC	daniel.loken6@mdc.mo.gov
Logan Zebro	SD State	logan.zebro@sdstate.edu
Kamden Glade	MN DNR	kamden.glade@state.mn.us
Chris Brooke	MO Dept. Cons.	chris.brooke@mdc.mo.gov
Blake Stephens	MO Dept of Conservation	Blake.Stephens@mdc.mo.gov
Alysah Doudlinger	SD State	alysah.doudlinger@sdstate.edu
Alison Coulter	SDSU	Alison.Coulter@sdstate.edu
Lin-Li Szczesny	UWSP	linliszcz83@gmail.com
Jamie Canalan	UWSP	jrcanalan08@gmail.com
Kyle Kamm	UWSP	KtKamm02@gmail.com
Sean Farrier	NGPC	Sean.farrier@nebraska.gov
Alex Engel	NGPC	alex.engel@nebraska.gov
Drew Holloway	INL NCD	[illegible]
Mark Fincel	SDGFP	Mark.Fincel@state.sd.us
Will Radigan	UNL	wradigan2@huskers.unl.edu
Dylan Gravenhof	SDGFP	dylan.gravenhof@state.sd.us
Todd Caspers	NDGF	tcaspers@nd.gov
Jason DeBoer	INHS	jadeboer@illinois.edu
Dan Dembkowski	UWSP	dan.dembkowski@uwsp.edu
Zach Feiner	WDNR	zachary.feiner@wisconsin.gov
Kevin Gaston	IDEM	kgaston2@idem.in.gov
Melissa Wuellner	Univ. NEB-Kearney	wuellnermr@unk.edu
Robert Allison	Univ NEB-Kearney	allisonr@lopers.unk.edu
Braeden Lensing	UW-Stevens Point	blensing@uwsp.edu
Max Wilkinson	UW-Stevens Point	mwilkins@uwsp.edu
Ryan Eastman	UW-Stevens Point	reastman@uwsp.edu



Rebecca Krogman - Iowa DNR Rep
Maddy Siller SDSU madalyn.siller@jacks.sdstate.edu
Hadley Boehm MNDNR hadley.boehm@state.mn.us
Hannah Lenning IADNR/UNK hannah.lenning@iowa.dnr.gov

State Reports:

Minnesota: No report submitted

Michigan WTC Update

Submitted by Jason Gostiaux

Production

Life stage	Fish stocked	Number of systems
Fry	3,214,166	5
Spring fingerling	1,466,361	51
Fall fingerling	16,668	16

Research

1. The Saginaw Bay population met its recovery targets in 2009, but the population continues to expand. Last year's population estimate was 12+ million age-2 & older fish as estimated by our Statistical-Catch-at-Age model.
2. The Saginaw Bay population increase is despite liberalization in the recreational fishery in 2015. A new management plan has been developed and adopted that changes the
   management objective from one of reduction (to benefit Perch survival) to one of sustainability and optimal use. So far it has not resulted in any change in the liberalized harvest regulations.
   a. There is pressure (litigation and legislation) pushing for a commercial allocation of walleye.
   b. Yellow Perch in Saginaw Bay continue to subside in a depressed state due to high juvenile mortality rates despite good reproduce success. We hypothesize the population has a recruitment issue, not a reproduction issue.
3. A new study to reveal relative proportions of reproductive contribution (by tributary and tributary vs reef) in Saginaw Bay makes use of acoustic telemetry. We are just getting our hands on year-2 data, and early returns indicate a much greater proportion of use of open water (reef) spawning than previously thought.
4. A third reef restoration project is underway in Saginaw Bay. This will be a near-shore reef in contrast to the offshore Coreyon project (built in 2019). The expected location will be on the east side of Channel Island, near the mouth of the Saginaw River. Pre and post evaluation is being conducted in partnership with Purdue University (Hook Lab).
5. As a Division, we are experimenting with walleye stocking evaluations using genetic typing of parent brood usage (pedigree analysis) with the expectation of

moving away from OTC based methods.

6. *Buchinger, T., T. Zorn, N. Johnson, and W. Li. 2024. Evaluating behavioral responses of spawning-phase Walleyes to odors of rivers and other Walleyes. Michigan Department of Natural Resources, Fisheries Division, Fisheries Report 42, Lansing.*

Management

1. Fish Division continues work on implementing Michigan DNR's Inland Lake Walleye Management Plan. General areas of focus include statewide monitoring of walleye populations, stocking evaluation protocols, and education & outreach. UP efforts include possible protected slot limit evaluations on a subset of lakes and using genetics to
evaluate stocking efforts (as opposed to OTC).
2. The Michigan Walleye Technical Committee will meet in February. The agenda will include progress reports related to the top 6 strategic actions from the Inland Management Plan.
3. Fisheries Divison's Tribal Coordination Unit has expanded staffing, and this will allow additional survey work focused on Walleye to occur in treaty waters.

Illinois: Submitted By Jason DeBoer

IL WTC Report, February 2025, submitted by Jason DeBoer INHS

Jeremiah Haas, Constellation Nuclear

We initiated a new RAS for the 2023 season, and stocked 255K walleye from the RAS system during Summer 2024 into MS River Pools 13 &14. The RAS continues to work well as we continue to learn its personality.

Logan Grimm and Mary Dunn, Sportfish Ecology Lab, Illinois Natural History Survey

Since 2019, the Sportfish Ecology Lab at the Illinois Natural History Survey (University of Illinos at Urbana-Champaign) has been collaborating with the Illinois DNR to assess walleye, sauger, and saugeye age structure and growth in Central Illinois lakes. Our main objectives are to investigate the comparability of otolith and whole dorsal spine age estimates, validate otolith and dorsal spine age estimates through oxytetracycline (OTC) marks, and create age-length keys for the three types of *Sander*.

In the spring and fall of 2024, DC boat-electrofishing surveys, consisting of four 15-minute transects per lake, were conducted to collect fish from six lakes (Lake Shelbyville, Dawson Lake, Lake Bloomington, Lake Decatur, Evergreen Lake, and Weldon Springs). Each lake was surveyed twice in the spring and once in the fall. A total of 37 walleye and 76 saugeye were captured in the spring, and in the fall, a total of 12 walleye and 47 saugeye were captured. For each captured fish, total length and weight were recorded and the second dorsal spine was removed for aging. Previous stocking of OTC-marked fish occurred in Lake Bloomington, Lake Decatur, and Evergreen Lake. Fish within a predetermined size bin (450- 650mm) on these waterbodies were sacrificed for dissection and otolith removal to check for OTC marks with no OTC-marked fish detected to date. Our lab has also received walleye dorsal spines from the Fox Chain O' Lakes (n=273) and Heidecke lake (n=42) from region 2 IDNR biologists. Fall 2024 marked the end of surveys for this project; therefore, in 2025 we will complete analyses for project objectives and submit a final report.

Nerissa McClelland, Illinois DNR

- IDNR Hatchery system stocked 9.8 million sauger fry (<1") and 459,172 sauger fingerlings (1.2 - 1.7") into the upper Peoria, Starved Rock and Marseilles pools of the Illinois River between April and June 2024.
- I don't have data analyzed or reports written yet, but I did anecdotally observe an increase in young Walleye in my fall, fixed-site electrofishing surveys on the ILR in 2024.

Seth Love, Illinois DNR

- District 8 lakes received 128k Walleye and 5k Saugeye.
- An experimental nighttime Walleye electrofishing survey was conducted on Heidecke Lake in Spring 2024 (data is being worked up this Winter).
- Have future Walleye nighttime sampling planned for 2025, locations to be determined.

Tristan Widloe, Illinois DNR

- Two sites on the Fox River were stocked with 81,727 Walleye fingerlings.
- Forty-six walleye broodstock were collected from the Kankakee River in Wilmington in March. Mean length was 444 mm. The largest Walleye collected was a female at 599 mm. Four sites on the Kankakee River were stocked with 145,296 walleye fingerlings.
- Two sites on the Des Plaines River were stocked w 91,589 Sauger fingerlings.

Boone LaHood, Illinois DNR

- East Fork Lake (Richland County): Walleye fingerlings are stocked annually (approximately 30,000 per year). The catch rate for the 2024 spring gillnetting survey was 9 per net-night. The fall 2024 electrofishing catch rate was 16 per hour. Anglers seem to be happy with the population and report being able to regularly catch walleye.
- Forbes Lake (Marion County): Saugeye fingerlings are stocked annually (approximately 30,000 per year). Catch rates in the spring gillnetting surveys and fall electrofishing surveys have historically been low. The spring gillnetting survey caught 7.3 fish per net-night and 1.5 saugeye per hour were collected in the fall shocking survey.
- Sam Parr Lake (Jasper County): Saugeye fingerlings were first stocked in May of 2024. Approximately 12,000 fingerlings were stocked at 1.6" long. No saugeye were collected in the fall surveys, but anglers reported seeing 5"-6" long saugeye by August. Gillnetting surveys will begin in March of 2025 to better sample this population.
- Borah Lake (Richland County): Approximately 8,000 saugeye were stocked at 1.6" long for the first time in May of 2024. No saugeye were collected in the fall survey, and spring gillnetting will be used in 2025 to sample this population. Many of the anglers that I've spoken to have been catching saugeye and some of the fish were nearly 11" long by early November.

Blake Ruebush, Illinois DNR

- Spring trap netting surveys were completed on West-Central IL lakes to assess Black/White Crappie, Muskie, and Walleye/Sauger/Saugeye populations. Lakes surveyed included SchuyRush Lake, Pittsfield Lake, Mauvaise Terre Lake, Lake Jacksonville, Siloam Springs Lake, Mt. Sterling Lake, and White Hall City Lake.

- Spring night electrofishing surveys were completed on Pittsfield City Lake, SchuyRush Lake, and Siloam Springs Lake to assess Walleye/Sauger/Saugeye populations.

County	Waterbody	Species	Length	#	Date
Adams	Siloam Springs Family Fishing Pond (85875)	Channel Catfish	4	30	9/4/2024
Adams	Siloam Springs Lake (00161)	Channel Catfish	4	744	9/4/2024
Adams	Siloam Springs Lake (00161)	Walleye	1.89	5351	5/22/2024
Hancock	Horton Lake (00163)	Channel Catfish	4	156	9/4/2024
Hancock	Carthage Lake (00571)	Largemouth Bass	4.2	2530	8/20/2024
Schuyler	Weinberg-King Pond 1 (00164)	Channel Catfish	4	120	9/4/2024
Schuyler	Schuy-Rush Lake (00450)	Walleye x Sauger (Saugeye)	1.3	10974	5/24/2024
Pike	Orr Ag Center Pond (04715)	Channel Catfish	4	60	9/4/2024
Pike	Pittsfield Rearing Pond (09313)	Largemouth Bass	1.25	5045	6/26/2024
Pike	Pittsfield Lake (00165)	Walleye	1.89	9785	5/22/2024
Morgan	Jacksonville, Lake (00173)	Channel Catfish	4	4284	9/10/2024
Morgan	Waverly Lake (00520)	Channel Catfish	4	1680	9/10/2024
Morgan	Ashland Old Reservoir (04611)	Channel Catfish	4	75	8/20/2024
Morgan	Ashland New Reservoir (04608)	Channel Catfish	4	150	8/20/2024
Morgan	Jacksonville, Lake (00173)	Striped Bass x White Bass	1.2	3948	6/20/2024
Greene	White Hall City Lake (00541)	Channel Catfish	3.8	459	8/28/2024
Greene	Greenfield City Lake (00540)	Channel Catfish	3.8	797	8/28/2024
Greene	Roodhouse Park Lake (00190)	Channel Catfish	3.8	120	8/28/2024

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Rick Bushman, IL DNR, LaSalle Fish Hatchery

Sauger

Broodfish and Egg Collection

Collection of adult sauger broodfish was carried out at two tournaments held on the Illinois River. The weigh-in for each tournament was held at the Spring Valley Boat Club, Spring Valley, Illinois. The Illinois Walleye Trail (IWT) tournament (30 teams) was on Sunday March 17 (river temperature 46 °F) and the Masters Walleye Circuit (MWC) tournament (95 teams) was held on Friday-Saturday March 23-24 (river temperature 44 °F). The river level was normal. The tournament officials at the IWT provided two Rubbermaid tanks to hold the anglers fish baskets prior to weigh-in.

A total of 870 fish (sauger and walleye) were caught by the anglers on the three days fish were collected. At the weigh-in, sauger were separated by sex and the fish were transported to the hatchery in 1 ton hauling trucks. A total of 275 female sauger and 176 male sauger were taken to the hatchery from both tournaments. The remaining sauger and walleye were transported to a release site on the Illinois River immediately following the tournament weigh in.

Upon arrival at the hatchery, the male sauger were placed in a 600-gal tank with flowing well water chilled to 53 ºF. Sauger males collected at the IWT were injected with approximately 250 IU/lb HCG (0.4-0.5 ml/fish) on March 18. Sauger semen was extended according to Moore (1996) on nine occasions from March 18-April 3 (Table 2). The male sauger were re-injected with HCG at 250 IU/lb each time semen was extended.

Upon arrival at the hatchery, the female sauger from the IWT tournament were placed in the garage raceways with well water chilled to 53 ºF. On Thursday, March 21 (4 days after collection), the female sauger were checked for spawning. Eight of the females spawned on March 21 and 39 females were injected with 500 IU/lb HCG and placed in circular tanks with 58 ºF water.

A total of 226 female sauger and 155 male sauger were transported to the fish hatchery from the MWC tournament. The male sauger were injected with 250 IU/lb HCG (0.4-0.5 ml/fish) on March 22-23 as they were placed in the hauling tank at the weigh in. The female sauger were transported to the hatchery and placed in tanks with well water at 58 °F. The remaining 378 sauger and 20 walleye were transported to a release site on the Illinois River immediately after the weigh in each day. The female sauger collected at the MWC were checked for spawning on March 25, female sauger that did not spawn were injected with 500 IU/lb HCG.

The eggs were spawned using the “dry method” and fertilized with extended sauger semen. The semen was mixed with eggs both immediately prior to the addition of water and 30 seconds after the addition of water. The eggs and semen were stirred for 2 min, mucked with fuller’s earth for 3 min and rinsed in well water. The eggs were water hardened for 1.5 hours, then treated for 15 min in 100 ppm povidone iodine (Ovadine, Western Chemical Inc.). The egg baskets were then placed in well water and the eggs were siphoned into hatching jars.

A total of 18.6 million eggs were taken from 261 females collected at the two tournaments. A total of 12.4 million fry hatched, resulting in a 66.5% hatch rate (Table 3). The average weight of the female sauger was 2.1 lb (1.2-3.6 lb). A total of 273.8 ml of HCG was injected into male (86.5 ml) and female (187.3 ml) sauger. It took 7 to 9 d for the eggs to hatch (189-243 T.U.) at water temperatures of 58 °F. A total of 9.8 million fry were stocked into the Illinois River (Table 4), three LaSalle Hatchery ponds (1.875 million) and 750,000 were transferred to the Fin N Feather rearing pond.

Fingerling Production

Three 2.5 acre LaSalle Hatchery ponds (4,5,6) were stocked with 5-7 day old fry on April 10 and 13. The total number of fry stocked was 625,000/pond, which was an average of 250,000/acre. The ponds were finished filling to approximately 1/3 full seven days prior to stocking. The ponds continued to fill in stages after the initial stocking and were full at three weeks post-stocking. Filter socks (300 micron) were used on the inflowing lake water and although they required cleaning usually twice per day, they were effective at eliminating foreign fish species and large cladocera spp. from the water flowing into the ponds.

All ponds were fertilized with alfalfa meal. The initial fertilization rate was 160lb/acre the first week and 100lb/acre each following week. The total amount of fertilizer was applied on two different days each week. This was the "base" fertilization rate and adjustments to the fertilization rates were made depending on water quality and the zooplankton populations.

A total of 1,014,357 fingerlings were produced for stocking in state waters (Table 5). Fingerling harvest began on May 13 and ended on June 11. The fingerlings were cultured for an average of 47 d (33-62 d), averaged 1.5 inches (1.2-1.9 inches) and weighed 1,323 fish/lb (552-2,186 fish/lb) at harvest. A total of 757.2 lb of sauger fingerlings were produced (101.0 lb/acre). Fish production was above normal, averaging 135,248/acre. Survival averaged 54.1% in the ponds (Table 6). The 20 year fish production average is 583,225 (72,295/acre).

Pond water temperatures were moderate (low-mid 60's°F) at stocking (April 10-13). Unlike the past few years, temperatures maintained seasonal levels through April, with the lowest high temperatures in the mid 50's. By May 1, pond temperatures increased to mid 60's °F in the morning and upper 60's °F to low 70's °F in the afternoon.

Zooplankton populations developed rapidly and were comprised of a variety of rotifers, copepods and daphnia through most of April. The zooplankton populations in late April transitioned to a majority daphnia in two ponds and copepods in the other. By May 15, all three ponds had very little zooplankton remaining as a food source. Results from test seine sampling on May 8 revealed fish averaging 1.1 inches with very little food available and harvest began May 13.

Tribune and Cutrine Plus were used to control filamentous algae (Spirogyra and Pithophora) and chara. Treatments of Cutrine Plus liquid and Tribune were applied to the ponds as needed, individually or as a 50:50 mixture at 0.4-0.6 gal/acre depending on the severity of the algae growth. Treatments began April 9 in Pond 6 and April 30 in Ponds 4 & 5 and were applied, as needed, through the second week of June. Cutrine granules and Copper sulfate were applied to all three ponds in late May to help control chara. Aquathol K was used to control pondweed in late May in Pond 6 at a rate of 0.5 gal/acre. The total amount of liquid chemicals used in each application was diluted with 40-60 gallons of water and applied using a HYPRO power sprayer.

Walleye

<u>Broodfish and Egg Collection</u>

Broodfish were collected from the Kankakee River and Fox Chain O'Lakes (FCOL). Upon arrival at the hatchery the fish were separated by location. They were also separated into two groups: green females and males. Ripe flowing females were spawned immediately off the truck and green females were injected with 500 IU/lb HCG.

Broodfish collection on the Kankakee River was performed by Region 2 Streams personnel and was carried out on March 20 and 25. A total of 9 females were collected from the Kankakee River on March 20 and one spawned upon arrival at the hatchery. Five females were injected with 500IU/lb HCG. A total of four females were collected on March 25, however, two were spent and two were immature. A total of 32 male walleye were collected on March 20, semen was extended upon arrival, and all fish were injected with 250 IU/lb HCG. The average weight of the females was 3.0 lb (1.4-5.2 lb).

A total of 730,000 eggs were collected and incubated in three separate batches. Egg volume averaged 100,000/L with an average of 121,667 eggs collected per fish. The eggs were fertilized with both extended and fresh semen, water hardened, and treated with iodine identical to the sauger eggs. The eggs began hatching in 8 d and continued to hatch until 10 d (216 T.U.) at a water temperature of 59

°F. A total of 440,000 fry (60.3 % hatch rate) were stocked in one LaSalle Hatchery pond (13) on April 4-5. A higher-than-normal stocking rate was used due to early stocking of the fry and the possibility of water temperatures below 45°F early in the culture period.

Region 2 personnel electrofished the FCOL April 1,2 and 5. Broodfish were held at the Spring Grove Hatchery Park overnight and picked up the next day. A total of 106 walleye females were transported to the hatchery on April 2,3 and 6. Twenty-three of the females spawned upon arrival at the hatchery, the remaining females received a 500 IU/lb injection of HCG. The females averaged 4.9 lb (1.8-8.9 lb). On April 2, a total of 77 male walleye from the FCOL were transported to the LaSalle Fish Hatchery. Upon arrival 35 male walleye were used for spawning ripe females, injected with 250 IU/lb HCG and placed in the big green tank at 53 °F. Semen was extended (42 flasks, 3:1) from the remaining 42 males before placing the fish in a garage raceway at 53 °F. An additional 63 male walleye were received from the FCOL on April 3. A total of 32 were injected with 250 IU/HCG and placed in big green tank. The remaining 31 males were extended (30 flasks, 3:1) and were injected with 250 IU/lb HCG before placing them in the garage raceway.

The fish were spawned using the dry method. The eggs were fertilized with extended semen prior to the addition of water and with two males approximately 30 sec after the addition of water. The eggs were stirred for two min, mucked with fuller's earth and rinsed in well water. The eggs were water hardened for 1.5 hours, then treated for 15 min in 100 ppm povidone iodine (Ovadine, Western Chemical Inc.). The egg baskets were then placed in well water and the eggs were siphoned into the hatching jars.

A total of 8.2 million eggs were collected from 72 FCOL walleye females from April 2-April 9. Egg volume was 104,000/L with an average of 114,180 eggs/fish. A total of 5.1 million eggs hatched (62.2%). The fry were stocked as follows: 2.0 million (6 LaSalle Hatchery Ponds), 420,000 (3 Jake Wolf Hatchery Ponds), 200,000 (1 Otter Slough Hatchery Pond), 1.7 million FCOL, 700,000 Fish Hook Marsh (Table 7).

Fingerling Production

A total of 2.0 million FCOL walleye fry were stocked into six hatchery ponds April 14-16 (4-6 day old). One pond (13) was stocked with 440,000 Kankakee River walleye fry (2-7 day old) on April 5-6. Stocking rates ranged from 133,000-220,000/acre. The ponds were finished filling to 1/3 full 4-11 days prior to stocking. The ponds were filled to 2/3 full two weeks after the initial fry stocking.

Lake water was filtered through 300 micron filter socks before entering the ponds. The fertilization rate was 160 lb/acre the first week and 100 lb/acre each week thereafter. The fertilizer was added to the ponds in two separate applications each week.

A total of 1,546,125 fingerlings were produced for stocking various lakes and rivers in Illinois including 370,809 in the FCOL, 236,550 in Clinton Lake, 113,506 in the Kankakee River and 94,819 in the Rock River (Table 8). The fish were cultured for an average of 45 d (32-66 d), the average length was 1.6 inches (1.2-2.1 in) at harvest. The fish weighed an average of 1,261 fish/lb (413-1,870 fish/lb). Overall survival averaged 63.4%, with a range from 26.9-87.5% (Table 9). Fish production was above normal, averaging 93,311/acre. A total of 1,412.6 lb of walleye fingerlings were harvested (86.1 lb/acre). The 20 year fish production average is 1,015,022 (63,834/acre).

Kankakee River fry were stocked in Pond 13 on April 5 & 6. Pond temperature was still in the mid 40's. A few days later, afternoon temperatures increased into the upper 50's- low 60's. The Fox chain fry were stocked April 14-16. Seasonal temperatures continued through the end of the production run.

Low to moderate numbers of zooplankton, consisting of rotifers, copepods and daphnia were present in all the ponds through most of April. All ponds except Ponds 7 & 9 had high densities of zooplankton by late April- early May. By mid-May, zooplankton populations began decreasing significantly in all ponds and lack of feed became a significant problem. Results from test seine samples on May 8 revealed good survival of fingerlings in most ponds, averaging 1.0 inches, with fish harvest beginning May 15.

Filamentous algae (Spirogyra and Pithophora) and chara in the ponds were treated with Cutrine Plus liquid and Tribune either individually or as a 50:50 mixture at 0.33-0.8 gal/acre. Treatments were carried out, starting in late April through the first week of June on an, as needed basis. Two ponds required Aquathol K in late May, to control pondweed, at a rate of 0.5 gal/acre. The total amount of chemical used in each application was diluted with 25-50 gal of water and applied using a HYPRO power sprayer. Cutrine granules alone or in combination with copper sulfate were applied to four of the ponds to help control chara growth. Ponds 1 & 7 received treatments of Hydrothol 191 granules at 20-40 lb per pond.

Walleye x Sauger Hybrids

Eggs from 16 female walleye from the FCOL were used for production of saugeye in 2024. All the fish were injected with HCG at 500 IU/lb to initiate ovulation. A total of 2.1 million eggs were collected April 3 and April 6. The 1.2 million fry hatched (56.3%) in 7-8 days. The fry (600,000) were stocked in LaSalle Hatchery ponds 11 and 12, Lake Evergreen (426,000) and Otter Slough Fish Hatchery (200,000).

Both ponds were stocked with 3-5 day old fry on April 14 (150,000/acre). The ponds were finished filling to 1/3 full 3-7 d prior to stocking. The ponds were fertilized with alfalfa meal only. The fertilization rate was 133lb/acre the first week and 100 lb/acre each week thereafter. The total amount of fertilizer was applied to the ponds in two separate applications each week.

A total of 319,133 fingerlings were raised for stocking in lakes (Table 10). The fingerlings were cultured for an average of 39 d (31-44 d). Average length at harvest was 1.4 inches (1.2-1.6) and average weight was 1,521 fish/lb (971-1,871 fish/lb). Fish production was normal, averaging 79,783/acre. A total of 218.6 lb of fingerlings were produced (54.7 lb/acre) (Table 11). Overall survival was 53.2%. The 20 year fish production average is 227,956 (73,514/acre).

Zooplankton populations of rotifers/copepods/daphnia in low to moderate abundance were observed throughout the production cycle. By the first week of May zooplankton populations were comprised of daphnia/copepods but in low numbers. Test seine sampling on May 8 revealed the fish present were 0.9-1.0 inches in length and harvest began May 15. Vegetation was controlled in the same manner as with the walleye and sauger ponds.

Aaron Ohrn, IL DNR, Jake Wolf Memorial Fish Hatchery

Walleye

<u>Fingerling Production</u>

Three lined one-acre ponds were used for 1-3" fingerling production. In preparation for fry, ponds were fertilized with 400 lbs of an algal blend fertilizer and 20 lbs yeast 7-10 days prior to stocking. After fertilizer was added, ponds were filled with water from the 22 acre solar pond. 420,000 fry were delivered to JWMFH from LaSalle Fish Hatchery on April 17, 2024. The fry were acclimatized using pond water and stocked at a rate of 140,000/acre. Zooplankton was sampled 1-2 times per week, we had high densities of daphnia throughout the production cycle. Supplemental fertilization occurred twice a week at a rate of 100 lbs/acre. The supplemental fertilization helped maintain zooplankton and provided enough organic matter to produce good numbers of bloodworms in the last week of production.

Test seining started on May 9th and growth was excellent. Walleye fingerlings were harvested on May 20, 21, 23 and brought inside for HACCP. The harvest yielded 319,553 walleye (76% survival at harvest) at an average size of 1.8 inches. JWMFH stocked 12 waterbodies with walleye. Pond details are as follows:

Date Stocked	Species	Pond	Fish Stocked	Date Harvest	Fish Harvested	Percent Return	Weight	Fish/lb	Length

4/17/2024	WAE	13	140000	5/23/2024	107480	76.77	200	537.0	1.83
4/17/2024	WAE	14	140000	5/21/2024	99819	71.30	181	551.6	1.81
4/17/2024	WAE	15	140000	5/20/2024	112254	80.20	190	590.2	1.78

Indiana Submitted By Aaron Voirol

Fawn River SFH-

A total of 40,048 advanced fingerlings stocked at an average length of 5.91 (in). These fish were stocked into 10 lakes and 1 river in northern Indiana. In 2025, a couple ponds will be turned into minnow production and the rest will be walleye production.

Year	Fingerlings	Start Size	% return	Ave-Length	Total Fish	Fry	% Return	Ave-Length	Total Fish	Total Fish
2021	157,417	1.42	16%	4.52"	25,002	119,852	1.45%	6.48"	1,736	26,738
2022	194,806	1.91	22%	5.4"	42,104					42,104
2023	185,401	1.51	13%	5.83"	24,398					24,398
2024	185,802	1.75	22%	5.91"	40,048					40,048

Water	County	Number	Size (in)
Adams	Lagrange	3,083	8.05"
Cedar	Lake	3,163	6.52"
Clear	Steuben	8,526	6.59"
Loon	Whitley	2,312	5.34"
Pine	Laporte	3,809	5.23"
Shriner	Whitley	1,200	7.46"
St Joseph River	Elkhart	7,833	5.27"
Stone	Laporte	1,282	5.23"
Sylvan	Noble	3,425	5.32"

Winona	Kosciusko	2,948	5.3"
Wolf	Lake	2,467	4.94"
		40,048	5.91"

East Fork SFH

A total of 328,000 walleye fingerlings stocked into 6 different locations at an average length of 1.5 (in).

A total of 108,000 hybrid walleye fingerlings stocked at an average length of 1.44 (in).

Walleye Stocking Locations						
Lake	County	Total Stocked	Number Stocked	Length (Inches)	Length Range (Inches)	Fish/lb.
Oakdale Dam	Carroll	25,000	25,000	1.43	1.28-1.58	1,500.0
Summit Lake	Henry	35,000	5,951	1.35	1.17-1.53	1,653.3
			29,049	1.50	1.27-1.74	1,151.4
Kokomo	Howard	4,434	4,434	1.38	1.25-1.51	1,478.0
Shafer	White	121,744	22,200	1.43	1.28-1.58	1,500.0
			42,132	1.55	1.40-1.71	1,186.8
			57,412	1.49	1.36-1.63	1,491.2

Cagles Mill	**Owen**	**83,645**	**36,178**	**1.40**	**1.26-1.55**	**1,247.5**
			10,494	**1.38**	**1.25-1.51**	**1,478.0**
			14,372	**1.50**	**1.27-1.74**	**1,151.4**
			22,601	**1.42**	**1.28-1.56**	**1,215.0**
Prairie Creek	**Delaware**	**62,600**	**62,600**	**1.35**	**1.17-1.53**	**1,653.3**
Total	**-**	**328,349**	**328,349**	**1.51**	**1.34-1.68**	**1,263**

Hybrid Walleye Stocking Locations						
Lake	**County**	**Total Stocked**	**Number Stocked**	**Length (Inches)**	**Length Range (Inches)**	**Fish/lb**
Huntingburg	Dubois	345,455*	345,455	-	-	-
Koteewi	Hamilton	1,400	1,400	1.43	1.26-1.60	1,371.2
Sullivan	Sullivan	52,035	21,800	1.45	1.25-1.65	1,434.2
			30,235	1.43	1.26-1.60	1,371.2
Huntingburg	Dubois	18,800	18,800	1.45	1.25-1.65	1,434.2
Glenn Flint	Putnam	36,500	16,500	1.45	1.25-1.65	1,434.2
			20,000	1.43	1.26-1.60	1,371.2

District 1 (Northwest) Walleye Surveys

In the Spring, we conducted a survey at Lake of the Woods in Marshall County for both Black Crappie and Walleye. This survey used small Lake Michigan style trap nets and had an effort of six 24-hour net lifts. A total of 26 Walleye were collected for a catch rate of 4.3 Walleye per net lift. The Walleye ranged in length from 14.5 to 20.5 inches and ages ranged from 3 to 9 years old.

The fall saw us completing a couple of Walleye stocking success evaluations. Lake of the Woods in Marshall County had 4 hours of boat electrofishing effort, collecting 36 Walleye ranging from 7.4 to 25 inches. The age 0 catch rate was 1 walleye per hour of electrofishing, and 30% of Walleye collected were between 16 to 18 inches. Pine and Stone Lakes in LaPorte County were the other lakes surveyed for Walleye stocking success this fall, with each lake seeing an effort of 4 hours of boat electrofishing across two different nights. A total of 43 Walleye were collected from both lakes with Pine Lake accounting for 28 and Stone Lake the other 15 Walleye. Only 13 of the collected Walleye were age-1, making the catch rate 1.6 Walleye per hour. The lengths ranged from 9.7 to 21.2 inches and ages ranged from 1 to 7 years old.

District 2 Walleye Surveys

Completed fall stocking evaluations on Atwood, Adams, Pretty, Clear, Big Turkey and St. Jospeh River above Twin Branch impoundment.

District 3 (North Central) Walleye Surveys

2024 Fall Walleye Surveys Summary

In the Fall of 2024, District 3 Fisheries Biologists performed targeted Walleye surveys on Sylvan, Loon, Pike, and Shriner Lakes. On Sylvan Lake, biologists collected 129 Walleye from 8 stations totaling 2 hours of shock time. Walleye ranged from 10-23.4 inches in length and from 1-7 years of age. Other noteworthy catches form Sylvan Lake included the first Gizzard Shad documented by Indiana DNR personnel and 1 Northern Pike measuring 33 inches long.

On Loon Lake, biologists collected 39 Walleye from 4 stations for a total of 2 hours of shock time. All Walleye collected were over 16 inches with an average length of 19.16 inches. The largest Walleye collected during the survey was 27 inches in length. Ages ranged from 2-7 years of age.

On Pike Lake, biologists collected 92 Walleye from 3 stations for a total of 1.5 hours of shock time. Walleye ranged form 7.3-23.8 inches long and ranged from 1-8 years of age. Almost half (43) of the Walleye collected from Pike Lake were less than 10 inches in length.

On Shriner Lake, biologists collected 10 Walleye from 4 stations for a total of 2 hours of shock time. This survey had the lowest catch rate out of all the lakes sampled this fall, likely a result of

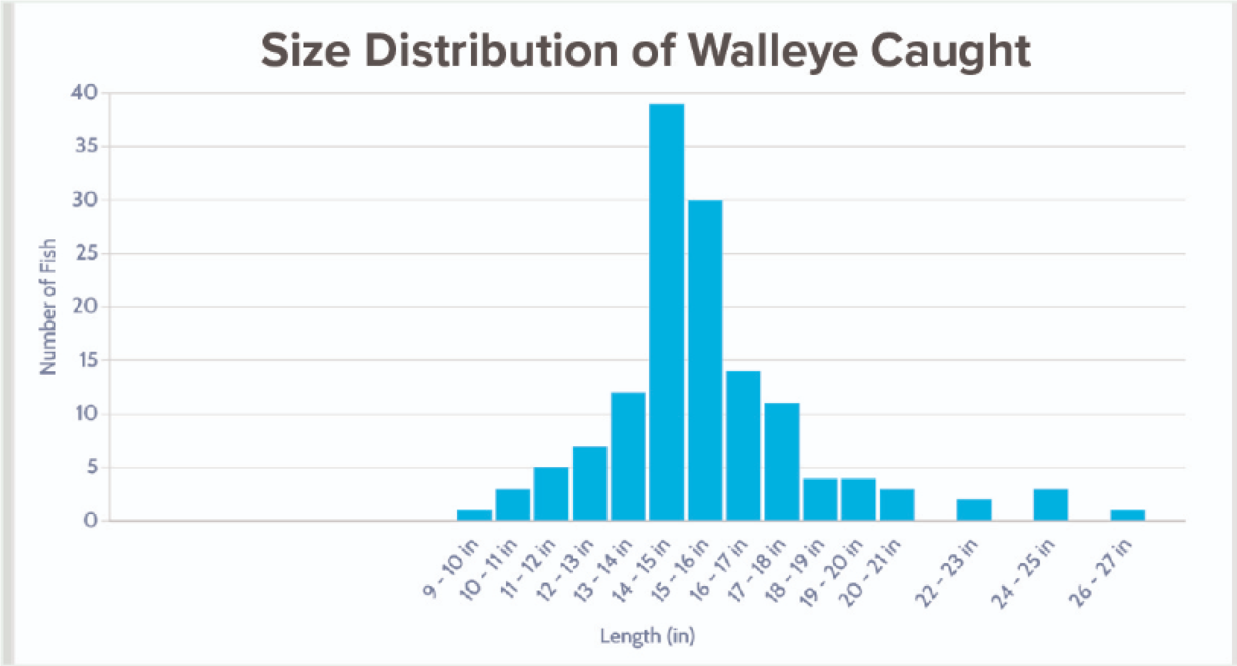
the super clear water of Shriner reducing the effectiveness of electrofishing. The Walleye collected ranged from 15.2-20 inches in length and 3-6 years of age.

District 4 (Central) Walleye Surveys

District 4 completed a total of four Walleye stocking evaluations on Brookville, Cagle's Mill, Summit and Prairie Creek and one saugeye stocking evaluation on Koteewi Park Lake. Catch rates of age-0 Walleye were average to above average for most lakes.

WAE Challenge

Overall, it was a slow spring for logged catches in Indiana. The top 3 lakes of catches were Brookville, Crooked and Patoka Lakes. Brookville had 89 fish logged into walleye challenge out of a total 140 fish. This spring, the challenge will continue and look to improve participation.



Kansas Report

No report submitted.

Nebraska Report Submitted by Joe Rydell.

Hatchery Production:

Walleye brood fish were collected from Sherman and Merritt Reservoirs in 2024 for production needs. Gillnets were run for 3 nights at Sherman from April 3rd through the 5th and collected 396 female walleye. Males were collected with electrofishing and milt was extended to reduce the number of males needed for production. A total of 140 females were spawned and averaged 1.14 quarts of eggs per fish. Fishery staff ran gillnets on Merritt for 5 nights starting April 9th through April 12th and came back on April 18th. A total of around 415 females were spawned. The majority of the egg take came from Merritt. The total spawn take was about 18.5 million eggs at Sherman and 91.6 million eggs at Merritt. Of that 35 million eggs were shipped out of state as part of trades. Nebraska stocked the following in 2024 with the advanced walleye to be stocked in 2025.

Walleye	Fry stocked in Nebraska	40 million
	Fingerling stocked	2.47 million
	Advanced to be stocked	18,161
Saugeye	Fry Stocked in Nebraska	5.4 million
	Fingerling stocked	900,000
	Advanced to be stocked	25,044

Some highlights from the production season include the following notes:

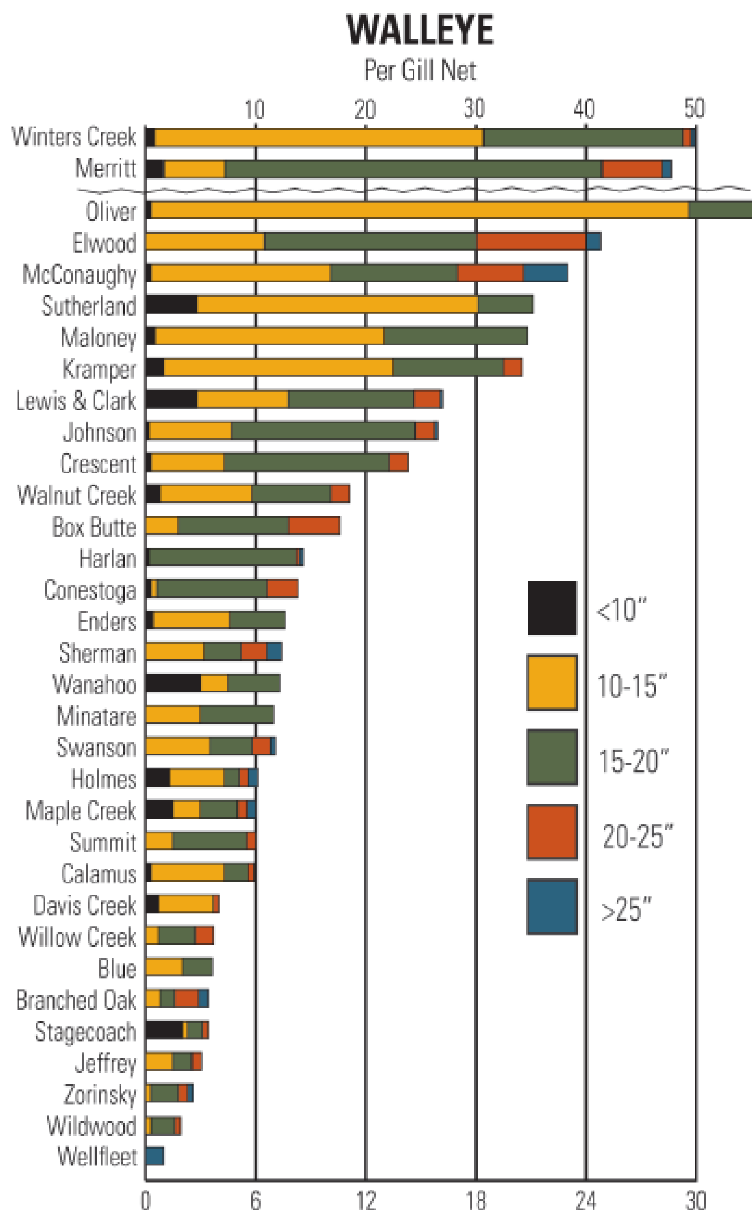
This was one crazy year on the walleye saugeye production. Lots of things going on: lined and unlined ponds at NP made for some crazy numbers from here (lined ponds produced 3 times the pounds that unlined did on these fish).

At North Platte we had different people measuring fry to go into ponds and that led to extremely large returns, which on the lined ponds showed that we could do more than we thought. Calamus got closer on pond returns with Whitney doing the measuring for the second year.

We Did RAS fish at Valentine, then moved them to NP and onto minnows. They performed very well until they were fin clipped to compared them with fish from Calamus that were fin clipped. Both were to be stocked into the same lakes for a direct comparison. Well, all the Calamus fish died and 36% of the NP RAS fish died. That study didn't go to well, but we had tried to warn them.

Walleye Surveys:

The following graph includes all the walleye gillnet surveys conducted in Nebraska in 2024.



WALLEYE
Per Gill Net
10
20
30
40
50
Winters Creek
Merritt
Oliver
Elwood
McConaughy
Sutherland
Maloney
Kramper
Lewis & Clark
Johnson
Crescent
Walnut Creek
Box Butte
Harlan
Conestoga
Enders
Sherman
Wanahoo
Minatare
Swanson
Holmes
Maple Creek
Summit
Calamus
Davis Creek
Willow Creek
Blue
Branched Oak
Stagecoach
Jeffrey
Zorinsky
Wildwood
Wellfleet
0
6
12
18
24
30
<10"
10-15"
15-20"
20-25"
>25"

Walleye Research

WALLEYE AND SAUGER MOVEMENT AND ENTRAINMENT IN LEWIS AND CLARK LAKE

William J. Radigan, Ph.D.

University of Nebraska, 2025

Advisor: Mark A. Pegg, Ph.D

Walleye *Sander vitreus* and Sauger *Sander canadensis* are both socioeconomically important sportfish species in Lewis and Clark Lake, an interjurisdictionally-managed mainstem Missouri River reservoir fishery. Since 2011, adult catch per unit effort (CPUE) of both Walleye and Sauger has remained at approximately 50% of pre-2011 levels. A presumed reason for the suppressed CPUE of adult Walleye and Sauger is substantial entrainment of larval and adult fish resulting from the reservoir's high turnover rate (7.2 d). Acoustic telemetry was used to quantify adult movement and entrainment and ichthyoplankton trawls were used to assess larval entrainment. Relative importance of factors driving larval entrainment through Gavins Point Dam (GPD), abundance of age-0 fish in the reservoir, and adult movement patterns were assessed using an information theoretic approach. The models with the most support for explaining variation in larval entrainment were week of year and air temperature for Fort Randall Dam (FRD) and water temperature, day of year, and cumulative days of sustained high discharge for GPD. Age-0 Walleye abundance was most supported by mean outflow through GPD, mean annual precipitation, and delta April gage height. Age-0 Sauger abundance was most supported by adult conspecific abundance, April heating degree days, and annual precipitation. Mean weekly adult Walleye movement was most supported by reservoir elevation, season, and mean

weekly air temperature. Mean weekly adult Sauger movement was most supported by discharge through FRD and season. We observed that annual larval entrainment (both total including all species and Walleye and Sauger entrainment) through GPD is generally greater than larval entrainment through FRD during 2021-2024. Further, entrainment and exploitation are considerable sources of loss for adult Walleye and Sauger. Our findings suggest flow is a driving factor affecting abundances of larval Walleye and Sauger and flow is affecting abundances and movement patterns of adult Walleye and Sauger in the reservoir.

South Dakota Report Submitted by Dlyan Gravenhof.

Update of SD Walleye Happenings

Will Radigan – University of Nebraska Lincoln & Chamberlain office of SD Game, Fish & Parks

We utilized mark-recapture models to assess walleye and sauger movement among four management zones (i.e., roughly quarters of the reservoir) on Lewis and Clark Lake, a mainstem Missouri River reservoir. Adult walleye (n=134) and sauger (n=79) were implanted with acoustic tags and movement patterns were assessed from 2021-2024. Receivers (*n =* 14) distributed throughout the entire length of Lewis and Clark enabled quantification of the amount of movement into each management zone. The relationship between variation in mean weekly movement and environmental factors (e.g., drought, precipitation, temperature) and flow characteristics (e.g, discharge, reservoir elevation) was assessed using multiple linear regression. Exploitation (derived from angler-reported tags) and entrainment estimates assessed from fish detections on receivers placed below Gavins Point Dam were assessed.

A multistate live-dead model approach suggested walleye apparent survival (mean 88%) varied among seasons, and transition and resight probabilities varied among zones. We found walleye movement was driven primarily by reservoir elevation, season, and temperature. Increased temperature was correlated to increased mean weekly male walleye movement. Seasonal walleye concentrations were evident below Fort Randall Dam in the spring and above Gavins Point Dam in the winter. Annual walleye exploitation estimates ranged from 6-19%, and annual walleye entrainment estimates ranged from 0-2.5%.

Sauger resight probabilities (mean 71%) varied among strata, and apparent survival (mean 83% probability) did not vary between sexes. Approximately 32% of female sauger and 18% of male sauger tagged in the delta never left this delta over the study duration. We found mean weekly sauger movement was driven primarily by discharge through Fort Randall Dam and season. We found both female and male sauger movement was negatively related to the day or week of the year and season. Increased reservoir elevation and storage was correlated to decreased mean weekly male sauger movement. Exploitation and entrainment were considerable sources of loss for adult sauger in the reservoir, with annual exploitation estimates ranging from 0-15%, and annual entrainment estimates ranging from 0-2.5%. Examination of adult walleye and sauger movement patterns and sources of loss enables fisheries managers to focus management on areas identified to be important for spawning and validates the appropriateness of maintaining current harvest regulations. Identification of exploitation and entrainment as considerable sources of loss in the reservoir provides a more holistic understanding of walleye and sauger population dynamics.

Benjamin Schall – Sioux Falls office of SD Game, Fish & Parks

SDGFP, in collaboration with SDSU, is investigating the utility of Walleye eye lens stable isotope analysis as a tool for natal origin assessment of Walleye. Large fingerling Walleye were collected directly from RAS tanks at Cleghorn fish hatchery, rearing ponds at Blue Dog fish hatchery, and from a lake environment to assess eye lens signatures. Lenses were peeled and sent to the Cornell Isotope Lab, where they were processed for Nitrogen and Carbon isotope signatures. Differences among groups were observed, with lower signatures occurring in pond-reared fish where prey fish were not available until later in the rearing process. RAS fish were fed pellets and had consistent signatures over time. Lake-reared fish had greater variability but intermediate signatures. Additional work is being done to assess sulfur signatures, and a follow-up evaluation of small fingerling signatures is currently being conducted from multiple sources.

SDGFP, in collaboration with South Dakota Walleyes Unlimited, is assessing Walleye genetics in South Dakota. The objective of this study is to assess stock structure in lakes across eastern South Dakota and Lake Oahe for unique genetic strain persistence. Additionally, this project is hoping to estimate the degree of Sauger introgression in Walleye in Lake Oahe. Twelve waters were sampled in 2024, and fin clips were sent to the University of Wisconsin Stevens Point for genetic assessment. Many of these waters are Walleye spawning sources and provide the majority of eggs for the state's stocking practices. Results will allow SDGFP to adapt spawning and stocking strategies in an effort to bolster natural recruitment.

Gene Galinat – Rapid City office of SD Game, Fish & Parks

Western South Dakota stockings of walleye raised in a recirculating aquaculture system

Cleghorn hatchery in Rapid City, South Dakota, one of the state's two cold-water hatcheries, has recently added cool and warm water species to its list of fish produced. The hatchery is accomplishing this through the addition of recirculating aquaculture systems (RAS). One of the species now being raised and stocked from the hatchery is walleye. The addition of the RAS raised walleye has greatly reduced transportation costs and time that was needed to stock waters in western SD, which was historically accomplished by state and federal hatcheries in eastern SD. While natal origins have yet to be identified during most annual sampling efforts, data indicates RAS stockings are contributing to walleye fisheries across western SD. Two lakes that recently winterkilled and had walleye introduced through RAS stockings are showing impressive results.

Small RAS walleye fingerlings (N = 14,000 at 2,900/lb) were introduced in Spring 2023 into Belvidere Lake, a 42-acre reservoir with mean depth of 4 ft and max of 10 ft. Sampling in 2024 indicated good survival and growth. During 2024 summer trap netting, 72 were recaptured in 5 nets and averaged 249 mm (±3; 95% CI) and 37 were recaptured during 40 minutes of fall night electrofishing, averaging 342 mm (±7; 95%CI) in length.

Similar to Belvidere Lake, RAS walleye fingerlings did exceptionally well in Owen Lake, a 96-acre reservoir with mean depth of 6 ft and max depth of 15 ft. Small RAS fingerlings (N = 25,374 at 756/lb) were introduced in Spring 2023. During fall electrofishing in 2023, 16 were caught and averaged 201 mm (±8). In summer 2024, 215 were recaptured in 6 trap nets and averaged 234 mm (±1; 95% CI) and 4 more were recaptured during 60 minutes of fall night electrofishing and averaged 259 mm (±50; 95% CI) in length.

Mark Ermer – Webster office of SDGFP & Matt Ward – Blue Dog State Fish Hatchery

Earlier conversion to piscivory leads to improved walleye production metrics during second crop, but only larger individual fingerlings during third crop

Background and Approach: Fall fingerling walleye are being produced in drainable ponds using a three-crop strategy in which invertebrates are consumed during crops one (May to mid-June) and two (mid-June to late-July) with fathead minnow supplementation occurring during crop three (late-July through early October). Providing forage fish during second crop may influence walleye production. In 2024, we compared second and third crop production metrics between walleye that became early piscivores (second crop) to those that were late (third crop) piscivores. Initial stocking densities and fish size were not necessarily standard as fish size and numbers varied daily during the first and second crop harvests.

Potential Benefit: Some managers request fall fingerling walleye at 10 f/lb which can be challenging to achieve unless stocking densities are reduced such that number of walleye produced is diminished. Techniques that increase the number of walleye reared per area

to 10 f/lb would increase available pond space. Larger fall fingerling walleye may increase recruitment to the creel.

Second crop results with and without white sucker forage for earthen-substrate ponds

- **White sucker supplementation during the second crop enhanced all production metrics and provided more and larger walleye per hectare (Table 1). Improved survival of walleye with white suckers suggest that invertebrate forage may have been limited in earthen-substrate ponds during second crop.**

- **Walleye size variability was not measured within treatments, but higher size variability may lead to increased cannibalism during third crop. Something to keep in mind.**

Table 1. Mean (SD) walleye production with and without white sucker forage during second crop in earthen-substrate ponds during 2024.

Treatment	Wae/Ha	Yield (kg/ha)	Fish Size (g)	Survival (%)	No. of Ponds
With WHS	6,847 (371)	40.4 (8.0)	5.9 (0.8)	63.6 (3.4)	2
W/O WHS	2,952 (1,543)	7.2 (4.4)	2.4 (0.6)	41.8 (25.3)	4

Third crop results for early versus late conversion to piscivory

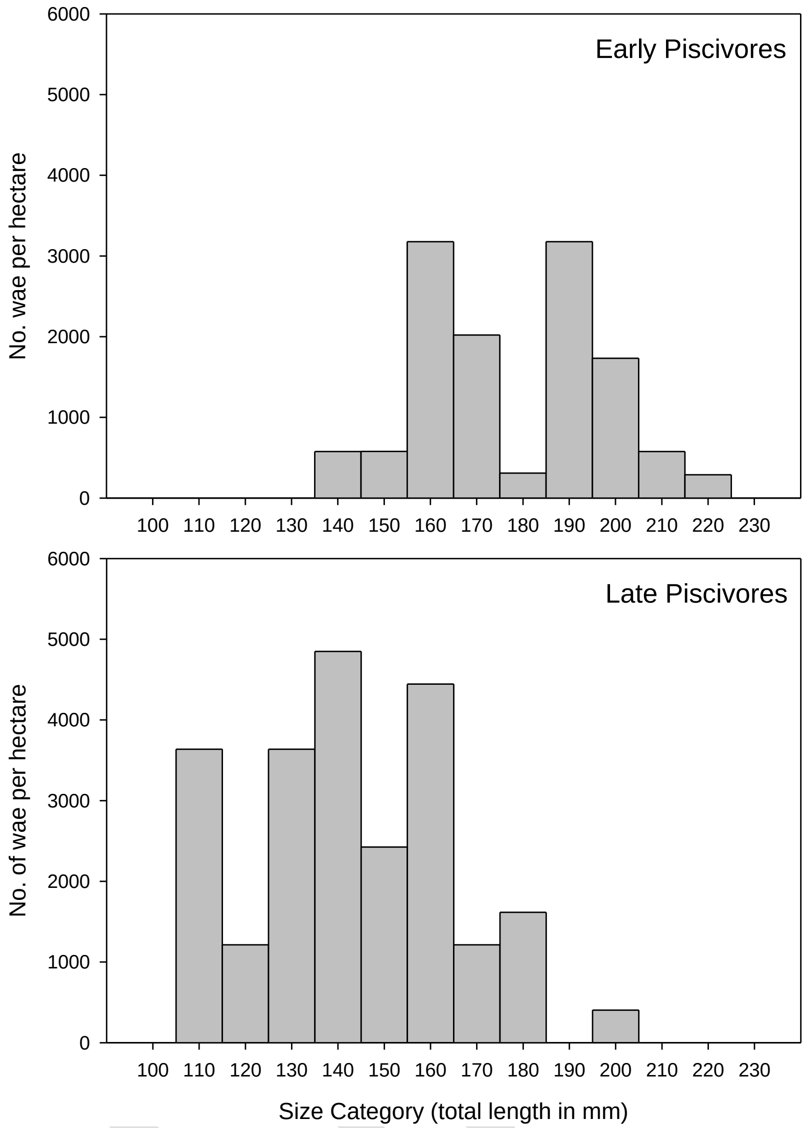
- **The size advantage continued through third crop for walleye that were early piscivores. Individual fish weights were 166% higher for early piscivores (Table 2). Average total length for early piscivores (182 mm) was 35 mm greater than late piscivores (147 mm) (Figure 1).**

- **Inferences regarding number of walleye per hectare are challenging as differing stocking and forage supplementation rates were used between treatments. However, survival was consistent between treatments suggesting that equal stocking densities would provide equal numbers of walleye per hectare between early and late piscivores (Table 2).**

Table 2. Third crop production metrics for walleye that were converted to piscivory either during second crop (early) or third crop (late).

Treatment	Wae/Ha	Yield (kg/ha)	Fish Size (g)	Survival (%)	Gal FHM/Ha	No. of Ponds
Early	**14,442**	**762**	**52.8**	**79.2**	**994**	**2**
Late	**23,437**	**720**	**31.8**	**83.8**	**789**	**5**

Figure 1. Size structure for third crop walleye that were either early (second crop) or late (third crop) piscivores.



Ohio State Report: No report submitted.

Iowa State Report Submitted by Rebecca Krogman.

Walleye Technical Committee

Iowa 2024 Report

Submitted by Rebecca Krogman, Iowa DNR

Change of Rep

This year, the Iowa Chapter representative will change to Madeline Lewis, Iowa DNR Large Impoundments Research Biologist.

Madeline.lewis@dnr.iowa.gov

Research Updates

Where's Walter? Using Acoustic Telemetry to Assess Use, Behavior, and Fate of Juvenile and Adult Walleye in an Iowa Reservoir

By William

Robert Cope

ABSTRACT

Reservoirs are complex systems with many competing stakeholders that can make fisheries management difficult, as fisheries are often not the primary concern of reservoir operators.

However, management to maintain populations of commercially and recreationally important species such as Walleye Sander vitreus is vital to reservoir operation. Walleye are commonly stocked in reservoirs; however, success of Walleye stocking is highly variable and can be due to many different reasons including environmental factors, poor post-stocking fitness, and inability to adapt to new systems. To combat variable stocking success, Walleye are commonly stocked at different life stages (fry or fingerlings) to enhance recruitment. Once recruited into the population, stocked individuals can still move and behave in different ways due to limiting factors of reservoirs or because of long-term stocking effects, especially as they move around outlet structures prior to potential escapement. These movements and behaviors can influence

harvest, escapement, and survival and can have important implications on stocking programs in reservoirs. Thus, the objectives of this study were to: (1) assess differences in movement, escapement, and survival probabilities between fall-stocked advanced fingerling and fry-stocked Walleye at two spatially disparate locations due to biotic (stocking product) and abiotic (stocking mortality, water temperature, reservoir discharge, stocking location) factors; (2) determine temporal shifts in reservoir use, population overlap, and spawning site fidelity in adult Walleye due to biotic (sex, spawning location) and abiotic (reservoir discharge) factors; (3) estimate and model use and behavior patterns of adult Walleye near a reservoir outlet tower in relations to biotic (fish sex, spawning location) and abiotic (temperature, season, time of day, reservoir discharge) factors to assess if behaviors are related to downstream escapement; and (4) estimate and compare natural mortality, escapement, and harvest probabilities of adult Walleye associated with biotic (fish sex, spawning location) and abiotic (temperature, reservoir discharge) factors. To complete these objectives we used an acoustic telemetry study to monitor juvenile and adult Walleye during a four- year period in Rathbun Lake, IA. We placed 40 acoustic receivers across Rathbun Lake and placed three receivers downstream in the Chariton River to monitor escapement. We tagged 59 fry-stocked and 100 advanced fingerling Walleye in November 2019 - 2021 and tagged 131 adult Walleye in April 2019 – 2023. We collected Walleye detections from acoustic receivers bi-annually and used space- use and multi-state modeling to quantify movement behaviors, and escapement and survival probabilities.

For the first objective, we used time-to-event analyses to evaluate timing of dispersal, main lake entry, and outlet tower arrival of fry-stocked and advanced fingerling Walleye from their separate stocking locations. We then used kernel density core (50%) and home (95%) range areas to determine reservoir use and overlap among individuals and a live-recapture multistate model to compare escapement and survival probabilities. More than half of the most uplake (Bridgeview) stocked individuals dispersed and entered the main lake within one month of stocking, but were slower to arrive at the outlet tower compared to the most downlake (Buck Creek) individuals that arrived within three months of stocking. Buck Creek individuals also resided near the outlet tower in a greater proportion than Bridgeview individuals (>0.8 by four months post-stocking). Home range areas covered 1.84-67.5% of lake area, with advanced fingerlings using larger areas than fry.

Initial spatial overlap among individuals was low, with advanced fingerlings having less overlap than fry, but long-term spatial overlap among all individuals was high (>0.5 by six months post-stocking).

Dam discharge positively influenced escapement probability and advanced fingerlings had higher escapement than fry. Advanced fingerlings also had lower survival than fry-stocked individuals and survival was inversely related to water temperature, but there was also a short-term stocking effect within the first week of stocking that gradually increased over the first six weeks post-stocking.

For the second objective, we used a 12-hr center of activity measurement to estimate adult Walleye positions in Rathbun Lake. We then used kernel density core (50%) and home (95%) range calculations to assess reservoir use and spatial overlap. We used pressure-sensing acoustic transmitter detections to determine depth use of Walleye. Finally, we used proportions of acoustic detections near spawning locations to estimate spawning site fidelity and residency. Walleye core and home ranges, spatial use overlap with other individuals, spawning site fidelity, and spawning site residency increased during spawning season (March – April). Depth and relative depth use was deepest during winter (December – January) and shallowest during March. Spawning site fidelity among all individuals was high (0.91), but spawning site residency was low (<0.10), and was generally lower for Dam spawning individuals than Bridgeview individuals. Finally, home range sizes tended to increase and depth use decreased with increasing reservoir discharge.

For the third objective, we used a fine-scale acoustic telemetry (Vemco Positioning System) array to evaluate three-dimensional positions of Walleye in a 0.35 km2 area around the Rathbun Dam outlet tower. First, we used a multiple logistic regression to determine factors influencing Walleye presence near the outlet tower. We then used Generalized Additive Mixed Models (GAMMs) to assess factors associated with Walleye movement and behavior patterns near the outlet tower. Finally, we used a multiple logistic regression to quantify escapement probability given presence near the outlet tower. Overall, we collected 332,190 three-dimensional Walleye locations from 80 individuals and found Walleye were located near the outlet tower during springtime spawning season (days 60 – 120) and when discharge from Rathbun Dam was higher. Distribution around the outlet tower varied temporally, with Walleye using the riprap dam face in spring, deeper water during summer, spread across the entire area over winter. Walleye moved closer to the outlet tower during higher discharge, cooler temperatures, nighttime hours, and during spring. Walleye were deeper during high discharges, warm temperatures, daytime hours, and winter months. Walleye used larger areas near the outlet during high discharge, nighttime hours, spring months, and during longer visits. Movement rates were highest during low discharges and during summer. Finally, Walleye visited the outlet tower area for longer durations at cooler temperatures during spring and summer. Walleye escapement probability increased with reservoir discharge and decreased as distance from the outlet tower increased but escapement was unrelated to other behaviors.

Finally, for our last objective, we used a live-dead multistate model to estimate weekly detection, harvest, escapement, and survival probabilities. We then extrapolated weekly estimates to annual probabilities and compared the three sources of loss (natural mortality, harvest, escapement) to determine main sources of loss within the population. Weekly Walleye survival estimates ranged from 0.984 – 0.997 and were negatively associated with water temperature but were not associated with harvest. Escapement probability was negligible most of the year (<0.001), as all escapement occurred from February – June. Escapement probability was highest during March, and increased from 0.008-0.031 as Rathbun Dam discharge increased from 0.15 to 36.7 m3/s during this period. Males were harvested more than females and combined harvest probability increased from <0.001 at 1.0°C to 0.029 at 26.3°C. Annual natural mortality varied between 0.224 – 0.233, annual escapement varied between 0.015 – 0.084, and annual harvest varied between 0.105 – 0.135.

Comparison of loss indicate natural mortality and harvest are the primary sources of Walleye loss in Rathbun Lake, but harvest may be compensatory. Escapement was not a major source of loss during the study, although it was conducted during drought conditions, providing limited escapement opportunities.

This study of multiple life stages of Walleye in an aging Iowa reservoir provides valuable information for management of valuable sportfish resources. We found the behavior and fate of stocked juvenile Walleye varies among stocking products and stocking locations. Temporal shifts in space use and population overlap in adult Walleye did not warrant separate spawning stock management, but spawning location fidelity can influence escapement potential, if spawning locations are located near outlet structures. When near the outlet tower, Walleye behaved differently under different reservoir conditions, but escapement probability was low in relation to the number of detections near the outlet tower. Harvest of adult Walleye was low and likely compensatory, thus not affecting population abundance. Rather, natural mortality was the main source of loss in the population. Overall, these findings can inform management in different ways, including potential alterations to stocking regimes to improve stocking success, controlling losses through alterations to harvest regulations, and creation of escapement mitigation techniques to help maintain or increase population abundance of important sportfish.

Publications from the ISU Lab:

Olivencia, K, EE Grausgruber, M Fincel, and MJ Weber. 2024. A multifaceted approach for assessing potential competition between Smallmouth Bass Micropterus dolomieu and Walleye Sander vitreus in Lake Oahe, South Dakota. Fisheries Research. 276:107060.

Lewis, M, JC Tyndall, B Dodd, and MJ Weber. 2024. Economic evaluation of barriers to minimize reservoir sportfish escapement. North American Journal of Fisheries Management. 66: 677- 692.

Olivencia, K, EE Grausgruber, M Fincel, and MJ Weber. 2024. Smallmouth Bass and Walleye predation on stocked age-0 Walleye in Lake Oahe, South Dakota. North American Journal of Fisheries Management 44: 620-636.

Development of an Analytical Software Package for Evaluation of Potential Length Regulations by Fisheries Managers

Contact: Madeline Lewis

- Objective: To develop a user-friendly R-based version of FAMS
- Findings
  - Society-level working group is developing this tool together with the intent of sharing it with all fisheries professionals
  - Basic model has been developed into a Shiny app, the dynamic pool model is not yet complete
  - It needs your feedback!
- Status: A demo version will be featured on the AFS Monthly Webinar on January 28! https://fisheries.org/webinar-recordings/

Population Dynamics of Walleye and Sauger in the Upper Mississippi River

Contact: Rebecca Krogman/Joe Mrnak

- Objective: To evaluate effects of a protective slot limit on Walleye and Sauger in various Mississippi pools
- Findings
  - In Pool 8 where no slot limit exists, walleye catch rates decreased from 0.59 to 0.36 fish/min during wingdam electrofishing
  - In Pool 13 where a protective slot limit was instituted in 2004, catch rates increased from 0.30 to 0.72 fish/min
  - In Pool 11 where the same slot limit was instituted in 2020, evaluation continues but appears to have been effective at increasing the catch rate of adult Walleye
- Study status: Ready for completion report

Population Dynamics of Adult Walleyes in Iowa's Large Natural Lakes

Contact: Jonathan Meerbeek

- Objective: To monitor Walleye population dynamics in the Iowa Great Lakes and Storm Lake
- Findings
  - Gillnetting data indicates strong female Walleye populations in all broodstock lakes
  - Protective slot limits appear to be working well here as well; large 2013/2024 year-classes still detectable in populations
- Study status: Ongoing

Effectiveness of an Electric Barrer to Reduce Emigration of Walleye and Muskellunge in Iowa's Natural Lakes

Contact: Jonathan Meerbeek

- Objective: Evaluate the effectiveness of an electric barrier on the Spirit Lake spillway, on preventing escapement of sportfish
- Findings
  - 26 fish tagged in 2022; 40 fish tagged in 2023
  - So far over 6 million detections on the acoustic array in the lakes
  - In 2023, 3 fish moved downstream to the river (i.e., through the barrier), one moved backu up in 2024
  - Suspicion that most emigration occurred when the water was very high, flood, and barrier was not operational
- Study status: Ongoing, only one fish left in 2024

Evaluation of Recirculating Aquaculture Systems for Sportfish Culture

Contact: Alan Johnson

- Objective: To evaluate the use of RAS for Walleye egg hatching, larval rearing, and growout
- Findings
  - Deformity rates (jaw, sloped head, pinched head, opercula, short jaw, lordosis, scoliosis, humpback, compressed, broken isthmus) regularly increased from 2019 to 2023, peaking over 60%.

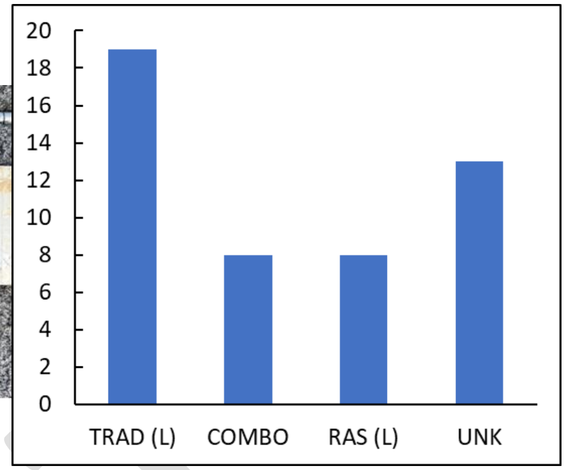
- Tested algae versus clay turbidity – no effect
- Tested water purification for source water – no effect
- Tested different fry sources – Early-spawned Kansas fry had almost double the deformity rate as natural-timed Iowa fry in 2023. Tested different feeds, suspecting an undocumented change in Otohime formulation.
- In 2024, both fry sources were used again, with a feed comparison of Otohime versus Gemma. This time, no difference in fry sources' deformity rates. Otohime-fed fish had a 71% deformity rate, whereas Gemma had a 24% deformity rate. Otohime gains its protein from krill, whereas Gemma gains it from fish meal; this affects micronutrients. Massive improvement in deformity rate with Gemma, but still not scalable for production.

- Study status: Diet comparisons will continue in 2025.

Relative Contribution of Advanced Fingerling Walleye Produced in a Recirculating Aquaculture System

Contact: Lewis Bruce

- Objective: To compare the survival to adulthood of stocked Walleye produced by traditional raceway methods, recirculating aquaculture system methods, or a combination of each (larval RAS, raceway growout)
- Findings
  - Tracking of 40 fish (20 each of traditional and RAS fish) with digestive acoustic transmitters imply a possible difference in susceptibility to predation. A greater proportion of RAS fish were consumed than Traditional fish at both locations stocked, with a greater difference at the reservoir with a major heron rookery. One tag was recovered below the trees at the rookery.
  - Additional stocking hindered by lack of healthy RAS fish; hopeful to continue this next year
  - Fish have shown up visibly identifiable in the MyCatch photo records via the 2023 and 2024 Walleye Challenge – potential future study ideas, anyone?
- Study status: Ongoing



Proportion of Field Recaptures from each Source

Comparison of Walleye Strain Performance in Large Reservoirs

Contact: Madeline Lewis

- Objective: To determine whether the hatchery-strain or river-strain Walleye contribute differentially to reservoirs of varying environmental characteristics, and whether they differ in growth or condition
- Findings
  - The two strains can be differentiated using a SNP panel (same as Wisconsin's panel), and the hatchery strain was actually reasonably genetically diverse
  - Fry stocking occurred at 11 reservoirs with 50:50 ratio (Coralville, Macbride, Pleasant Creek, Don Williams, Roberts Creek, Rock creek, Summit, Anita, Big Creek, Brushy Creek, Twelve Mile), but had known issues with fry survival
  - Low recapture rates limit our conclusions, but it did seem that river-strain survived better to stock size in several reservoir types
- Study status: Shifting direction to stock more heavily in fewer reservoirs and continue evaluation (Big Creek and Brushy Creek only), may shift to advanced fingerlings too

North Dakota Report Submitted by Todd Caspers

<u>State Report for North Dakota at the 2025 Winter Walleye Technical Committee Meeting.</u>

The walleye population in Devils Lake is doing well. There are many age-classes of walleye in the lake and some of the fish can become quite old, as fish up to 22 years old have been encountered.

We conducted our Standard Adult Sampling on Devils Lake in July. Results showed the overall CPUE of walleye was 22.6 walleye/net-night in our 125' variegated gill nets. The catch in 2024 was down significantly compared to the previous year (32.4 walleye/net-night). The catch rate of Q-P sized walleye in 2024 declined to 8.2/net-night compared to 12.4/ net-night the year before. The catch rate for Q-P sized walleye was still above average. The northern pike catch was about average, as was the white bass catch. Yellow perch numbers were a bit below average. About 480,000 fingerling walleye were stocked in the eastern, more saline portion of the lake in 2024. We observed good results from our young of the year netting survey in September, with about 43 young walleye being caught per net, which was above the average of about 26. Overall, we've observed 9 good year classes of walleye in a row now, so the future is promising for walleye in Devils Lake.

One of our other large lakes, Stump Lake is doing well too. We conducted our Standard Adult Sampling there in late June. The walleye population appears to be doing very well. Our catch fell from a record high set last year, but was still well above average at 25 walleye per net-night. There were a record number of walleye over 20" captured last year, but the catch of large walleye fell this year to about 6/net-night, which is well above average. The northern pike numbers were near their long-term average, but yellow perch numbers were a bit below average. White bass set a new record high at 10 fish per net-night.

In the Northeast District of the state, some of our most impressive walleye waters continue to be new fisheries that were formerly duck-marsh type habitats. Some of these waters are also able to produce good numbers of walleye over 24" long.

Across the rest of the state, the good old days of walleye fishing, and fishing in general, continue to be right now. However, the winter of 2022-2023 was very long and harsh, and about 80 waters experienced some degree of winterkill. Statewide, there are about 440 waterbodies that are being managed for fishing. This is a great increase from only about 175 managed fisheries in the early 1990's. Since 1997 we added over 100 new walleye fisheries. State-wide there are currently about 230 waters that have walleye populations. The few places where walleye are not doing well is in the North Dakota portion of Lake Oahe and the Missouri River between Lake Oahe and Garrison Dam. The fishery within the Garrison Reach of the Missouri River continues to be impacted by habitat impacts following the 2011 Flood. Channelization and loss of productive backwater and braided channel areas have decreased productivity and resulted in poor condition as well as suppressed growth of walleye in this reach. Walleye condition and growth are similarly poor in the ND portion of Lake Oahe as recent water management has not been conducive to forage production.

Our state record for walleye was broken in 2021. That March, a 33-inch-long walleye weighing 16 pounds 6 ounces was caught in the upper portion of Lake Oahe. This fish bested the previous record of 15 pounds 13 ounces that was caught in 2018.

Our department stocked nearly 12 million walleye fingerlings in 178 lakes in 2024. The fingerlings were generally about 30 days old and were around 1.25” long. About 10 million fry were also stocked in 28 waters, and advanced fingerlings were stocked in 2 waters.

There are several walleye tagging studies currently underway in North Dakota, with fish being tagged in the spring of 2024. The aim of the studies is to estimate angler exploitation and population size for each lake.

Known zebra mussel populations exist in the Red River, Lake Ashtabula and the lower Sheyenne River, Lake LaMoure, the lower James River (downstream from Lake LaMoure), Twin Lake, Lake Elsie and Lower Lake Oahe in South Dakota. In 2024, zebra mussels were discovered in South Golden Lake and due to its connection with North Golden Lake, that lake is considered to be infested as well.

Missouri State Report submitted by Robert Weber.

2024 Lost Valley Hatchery Walleye Production Report

By: Drew Burdick

Production for lake strain walleye was down this year thanks in part to cold temperatures at the time of fry stocking our production ponds. Luckily, the system works together as a whole to cover to all the stocking requests for the state. In total, staff stocked all targets only shorting Truman Lake, coming to a total of 1,516,474 lake strain fingerlings stocked statewide (see attached spreadsheet).

With that said, the Black River (Walleye management areas) fish had a great year as it was unseasonably warm during stocking. In total, staff stocked 130,976 Black River strain fish into these special management areas, which is 27,976 over the request.

Stocking Date	Requested Size	Requested Count	Stocking Target	Stocking Target Group	Hatchery	Requested Species	Count
5/2/2024	< 4"	52,000	Walleye Management Area	Current River	Blind Pony Fish Hatchery	walleye	63,380
			Walleye Management Area Total				63,380
5/2/2024	< 4"	51,000	Walleye Management Area	St Francis River	Blind Pony Fish Hatchery	walleye	67,596
			Walleye Management Area Total				67,596
			Grand Total				**130,976**

Table 2. 2024 production summary for Black River strain walleye

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2024 Chesapeake Hatchery Walleye Production Report

By: Brad Russell

Objective

1. Produce at least 1,560,000 walleye fry to stock 13 one-acre hatchery ponds each with 120,000 fry. Chesapeake request is to stock 384,000 fingerlings into Bull Shoals Lake and 176,000 into Norfork Lake.

Bull Shoals Walleye Production

Broodstock walleye are not kept at Chesapeake Hatchery and must be collected during the spring spawning run. In 2024, collection took place on 3/17/24 at Lake of the Ozarks and Chesapeake transferred broodstock from Lost Valley Hatchery on 3/19/24. 56 females and 76 males were hauled in two 1-ton trucks. After all brood was collected and transferred to the hatchery, the females were weighed, and egg samples were staged. All females that were green were injected with HCG at a rate of 0.25cc/lb., while those close to spawning were not injected. Spawning took place over the next few days and was completed on 3/25/24. Chesapeake ponds were stocked with 1,602,084 fry.

Female Walleye Summary

Collected	**56**
Injected	**56**
Spawned	**56**
Bloody or clumpy eggs	**4**
Dumped	**1**
Spent	**0**
Average female weight	**3.45 lbs.**
Average # of quarts/female	**.81 qts.**
Average # of eggs/quart	**138,596**
Original # of eggs collected	**6,521,102**
# of eggs after dumping or sucking	**6,407,490**
# of fry hatched	**~2,602,084**
Original # of quarts taken	**45.47 qts.**
Quarts left to hatch after dumping or sucking	**44.51 qts.**
Percent hatched	**40.6 %**

Hatchery ponds 2-14 were utilized for walleye production. All ponds are one acre in size. The ponds had been filled during late January to help avoid algae treatments and leaves in the ponds. Ponds were filled with solar pond water. The ponds were fertilized with alfalfa meal to stimulate plankton growth. No vegetable oil was applied to the ponds for insect control. Grass carp were not used in the ponds for additional algae control. Fry were stocked at 212 fry per gram. Dissolved oxygen levels were monitored twice a day after fry were stocked. Air lift pumps or paddlewheels were turned on at the time of fry stocking and run throughout the grow-out period to keep the water mixing, add some aeration, and breakup the water surface tension. Refer to chart below for fertilization and treatment totals.

2024 Walleye Pond Fertilization and Treatments

Pond	Alfalfa Meal	Cutrine Plus	Reward/Tribune
2	800 lbs.		
3	800 lbs.		
4	800 lbs.	1.5 gal.	
5	800 lbs.		
6	800 lbs.		
7	800 lbs.		
8	800 lbs.	3.0 gal.	
9	800 lbs.	1.5 gal.	1.5 gal.
10	800 lbs.		1.5 gal.
11	800 lbs.		3.0 gal.
12	800 lbs.	1.5 gal.	3.0 gal.
13	800 lbs.		1.5 gal.
14	800 lbs.		
Totals:	**10,400 lbs.**	**7.5 gal.**	**10.5 gal.**

Walleye Pond Production

Pond	# Stocked	#Harvested	Lbs.	Length	Fpp	Return
2	125,716	86,496	81.6	1.5	1060.0	68.8
3	125,292	54,479	52.0	1.4	1046.6	43.5
4	125,504	64,120	70.0	1.6	916.0	51.1
5	125,928	71,721	65.3	1.5	1098.3	56.9
6	126,140	10,608	17.0	1.9	624.0	8.4
7	127,836	2,777	5.3	2.1	524.0	2.2
8	125,928	106,267	113.1	1.6	940.0	84.4
9	125,292	70,352	81.3	1.7	865.3	55.9
10	128,260	93,458	124.6	1.8	750.6	72.9
11	118,932	62,714	69.5	1.6	902.3	52.7
12	114,904	76,160	67.2	1.4	1133.3	66.3
13	115,964	80,724	97.6	1.6	826.6	69.6
14	116,388	88,665	86.7	1.5	1022.6	76.2
Totals:	**1,602,084**	**868,541**	**931.2**	**1.63**	**900.7**	**54.2%**

Fingerling Distribution

Lake	Date	Location	# stocked
Bull Shoals	5/13/24	K-Dock	245,549
Norfork	5/14/24	**Tecumseh**	176,354
Bull Shoals	5/14/24	Theodosia	139,470
Stockton	5/15/24	Crabtree	64,333
Pomme De Terre	5/15/24	Wheatland	4,243
Truman	5/15/24	Talley Bend	137,846
Lake of the Ozarks	5/15/24	Larry Gale	100,746
Total:			**868,541**

Discussion

Chesapeake Hatchery stocked out 868,541 walleye this season. A surplus of 307,168 walleye were stocked out of Chesapeake Hatchery to fill other commitments that were not able to be filled by other warm water hatcheries. MDC hatcheries work together to help each other out when able. The pond temperatures were warmer for us and that has a big impact on walleye production. On 4/05/24 we stocked approximately 1 million surplus fry into Lake of the Ozarks at Larry Gale access after we stocked our ponds with the fry amount that we needed. We will continue to get walleye brood stock from Lost Valley Hatchery so that we can help each other out to fulfill future commitments.

Recommendations for 2024 walleye culture:

- Fill ponds halfway with solar pond water to seed the pond, then use spring water.
- Fill ponds with filter bags to keep green sunfish out of the ponds.
- Start fertilizing ponds mid-March.
- Keep walleye ponds empty until late January or February to reduce growth of algae and leaves.
- Check walleye brood stock for flowing at 7 AM, 2 PM, and 10 PM.
- Place no more than 3 egg jars per aquarium to hatch. This will provide more room in each aquarium for fry and keep the hatch time close.
- Clean egg jars twice a day by siphoning off dead eggs and/or fungus. Do not treat with formalin unless the need arises.
- Determine average fry per gram before stocking to be more accurate.

- Collect brood stock from Lake of the Ozarks
- Stock fry around 2 days post hatch.
- Temper tubs at pond stocking time to get the pH close to pond ph.
- Make two trips to each pond when stocking and tempering.
- Turn on air lift pumps and paddlewheel aerators as soon as the fry are stocked into the ponds.
- Turn off paddlewheels when harvesting the ponds. If you leave them on it weakens the fingerlings and results in death upon transport.
- Switch water over to Solar water before pond harvest takes place
- When draining ponds, drain down 3 steps the first day, then bring down to 18 inches on day 2. Harvest on day 3.
- Use socks on aerators when hauling walleye fingerlings.

Table 1. 2024 production summary for Missouri lake-strain walleye

Fingerlings (1-2") Lake Strain (a)								
Water Body	**Production Category**	**Region**	**Priority**	**Acres**	**Stocking Rate**	**2024**	**Completed**	**Production Lake total Stocked**
Stockton Lake	P	SW	1	25,000	12/A	300,000	X	301,372
Smithville Lake	P	NW	2	7,200	30/A	216,000	X	216,000
Bull Shoals Lake	P	Ozark	3	48,000	8/A	384,000	X	385,019
Lake of the Ozarks	P	Central	4	55,000	3/A	165,000	X	166,085
Norfork Lake	P	Ozark	5	22,000	8/A	176,000	X	176,354
Mozingo Lake	P	NW	6	1,000	30/A	30,000	X	30,000
Longview Lake	P	KC	7	930	20/A	18,600	X	18,600
Lake Jacomo	P	KC	8	970	20/A	19,400	X	19,400
Lake Showme	P	NE	9	225	20/A	4,500	X	4,507
Harrison County Lake	P	NW	10	280	30/A	8,400	X	8,400
Pomme de Terre Lake	P	SW	11	7,820	6/A	47,000	X	47,131
Indian Creek Lake	P	NW	12	192	30/A	5,760	X	5,760
Truman Lake	P	KC	13	55,600	2.7/A	150,000		137,846
Bull Shoals Lake	S	Ozark	14	48,000	2/A	96,000		
Table Rock Lake (James River Arm)	S	SW	15	9,000	10/A	90,000		
Norfork Lake	S	Ozark	16	22,000	2/A	44,000		
Long Branch Lake	S	NE	17	2,400	10/A			
N & S Fork Salt Rivers	S	NE	18	46 miles	1,300/Mi			
Truman Lake	S	KC	19	55,600	1.1/A	50,000		
				Production Request		**1,524,660**		
				Surplus Request		**280,000**		
				Total Request (b)		**1,804,660**		

Building a case for holistic and conservative management of a genetically unique strain of Walleye in Missouri and Arkansas

Dave Knuth[1], Paul Cieslewicz[1], Blake Stephens[1], David Ostendorf[1], Leah Berkman[1], Brett Timmons[2]
Missouri Department of Conservation[1], Arkansas Game and Fish Commission[2]

ABSTRACT

The Black, Current, Eleven Point, and St. Francis rivers in southern Missouri and northeastern Arkansas contain the Interior Highlands strain of Walleye, which is more closely related to Eastern United States populations than other Missouri and Arkansas Walleye populations. Largescale efforts have been made to understand the genetics, movement, and population dynamics of the Walleye in these fisheries. Acoustic telemetry and reward tag returns from ongoing and past exploitation evaluations indicate largescale movements within and among rivers. Data also suggests spawning site fidelity and seasonal movement patterns. This riverine population exhibits significant sex-specific growth, with females reaching much larger sizes than males. This presents challenges when managing the fishery under current minimum length limit regulations. The Walleye population in these four rivers is currently managed with three different length-based regulations. In some circumstances, there is concern under current regulations that more harvest is directed at females within the population. Management actions are being evaluated collaboratively across state lines to ensure the sustainability and quality of this unique fishery.

GENETICS, DISTRIBUTION, AND MORPHOLOGY

- Berkman et al. 2023 identified a genetically distinct native population of Walleye in Missouri using microsatellite markers and mitochondrial DNA (Figure 1). These populations are uniquely different from all other Walleye found in Missouri or Arkansas and nationwide. This strain is closely related to the Eastern Highlands strain but genetically distinct.
- The genetically distinct self-sustaining populations of Walleye that occur in the Current, Black, and Eleven Point rivers and their associated tributaries are known as the Interior Highlands strain. This strain may have occurred naturally in the St. Francis River above Wappapello Lake prior to dam construction in the 1940s.
- This strain exhibits phenotypical differences from other walleye found in Missouri, having larger egg size and reaching greater sizes (Cornforth et al. 2010).

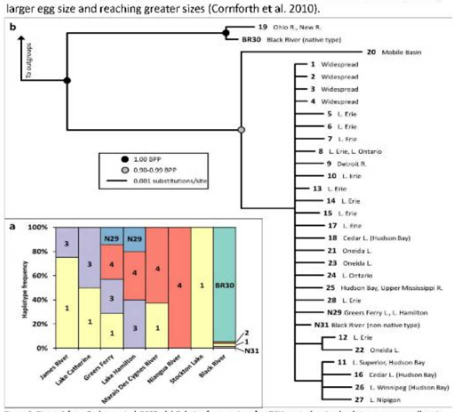


Figure 1. Figure 4 from Berkman et al. 2023. (a) Relative frequencies of mtDNA control region haplotypes among walleye in select waterbodies of Missouri and Arkansas. Haplotypes 1, 2, 3, 4 are common in the Great Lakes. Haplotypes BR30, N29, and N31 were newly discovered. (b) Bayesian phylogeny of all known unique walleye mtDNA control region haplotypes and the newly described haplotypes. Support for clades is based on Bayesian posterior probability (BPP) values. Low clade support (<0.9) has no circles.

POPULATION DEMOGRAPHICS

Size Distribution

- Long-term sampling data exist for Interior Highlands Walleye populations in the Current, Black, Eleven Point, and St. Francis rivers in Missouri.
- Length-frequencies for these populations exhibit bimodal distributions that are driven by sex-specific growth differences (Figure 2).
- Sex-ratios are heavily skewed towards males, likely as a function of sampling efficiency but this may also be affected by sex-specific harvest.
- Walleye under 12 inches (age 1 or younger) are not common in the Missouri portions of these rivers. However, they are commonly observed by the Arkansas Game and Fish Commission, indicating larval drift or preferred juvenile habitat in the lower portions of these rivers.

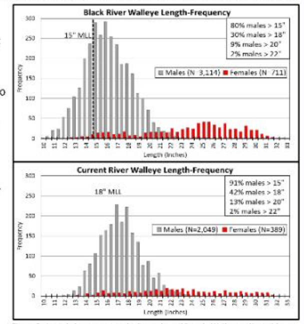


Figure 2. Length-frequency graphs for male and female Walleye collected from the Black (1995-2024) and Current (1999-2024) rivers with associated Minimum Length Limits (MLL).

Length-Weight Relationships

- Length-weight relationships show phenotypical differences between male and female Walleye, with females reaching greater weights (Figure 3).
- Males' maximum weight is approximately 5 pounds, whereas gravid females can reach over 15 pounds.
- The two most recent Missouri state record Walleye—20.5 lbs. (1961 St. Francis River) and 21.1 lbs. (1988 Bull Shoals Reservoir)—may have been Highlands strain Walleye.

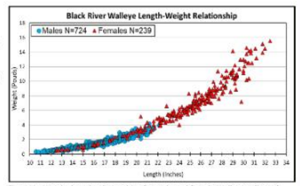
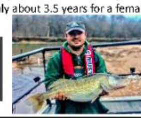


Figure 3. Weight-length relationships for male and female Walleye collected from the Black River from 2010-2024.

Age and Growth

- These populations of Walleye exhibit sex-specific growth (Figure 4).
- Walleye ages ranged from 2 to 11 years old.
- Females exhibit much faster growth than males and reach much larger sizes before approaching the asymptote.
- It takes approximately 5 years for a male Walleye to reach 18 inches, but only about 3.5 years for a female to reach 18 inches.



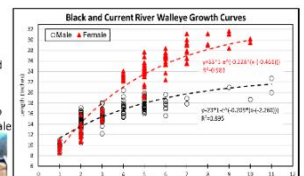


Figure 4. Von Bertalanffy growth curves for male and female Walleye collected from the Black and Current rivers from 2003-2024 with associated growth functions. All fish were aged using sagittal otoliths.

HARVEST EVALUATION

- Conducting a 2-year evaluation of Walleye exploitation in the Current and Black rivers
- Evaluating sex-specific harvest
- A total of 776 Walleye were tagged using double-anchored high ($75) and low ($25) reward carlin-dangler tags (Table 1).
- Angler compliance estimate of 89.1%

Table 1. Reward tag allocation and totals for males and females for the 2023-2024 exploitation evaluation.

Current River			
Year	Males	Females	Totals
2023	82	27	109
2024	71	31	102
Black River			
Year	Males	Females	Totals
2023	216	59	275
2024	184	106	290

- Preliminary 2023 Black River catch rates (CR) and harvest rates (HR):
  - Male CR 26.2% and HR 16.9%
  - Female CR 25.6% and HR 23.8%

MOVEMENT

- Since 2019, 47 Walleye were surgically implanted with Innovasea/Vemco V16-V13 acoustic transmitters (Black River N=28, Current River N=5, and Eleven Point River N=14).
- A stationary receiver array was established in the Black River Basin using 13 VR2s (Figure 5).
- Preliminary data show inter-river trafficking, repeated seasonal movement patterns, and spawning site fidelity.
- A total of 35% of the Walleye implanted with acoustic tags in the Black River have moved into Arkansas waters.
- Four Walleye have made repeated migrations to the Current River, then return to the Black River to spawn (up to 4 times and sometimes to the same spawning shoal).
  - Both male and female exhibit spawning seasonal migrations and site fidelity.
  - Current River may be selected during the summer months due to more optimal water temperatures.
- Long migrations are being documented over short periods of time (up to 30 river miles in 11 hours).
- Twenty percent of the angler returns of fish tagged in the Black River have been reported from the other rivers in the basin (total displacement up to 230 miles).

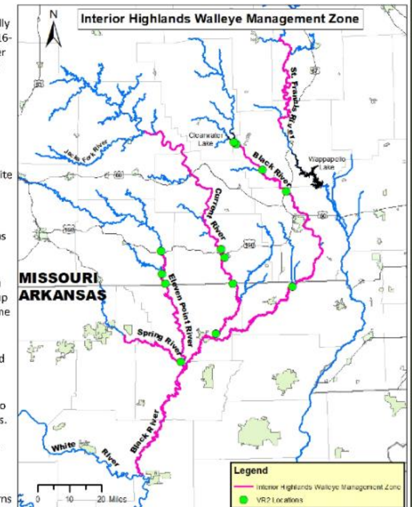


Figure 5. Map showing the management zone of the Interior Highlands strain of Walleye in Missouri and Arkansas. The map also shows the locations of the VR2 stationary receivers.

CURRENT MANAGEMENT

Missouri

- Current, Eleven Point, and St. Francis rivers: 18-inch Minimum Length Limit (MLL) and 4 daily creel
- Black River: 15-inch MLL and 4 daily creel
- Supplemental stocking in the Current, Black, Eleven Point, and St. Francis rivers on a 4-year rotation.
- Broodstock collection and genetic mtDNA testing to ensure native genetics are preserved

Arkansas

- Black River Basin and St. Francis River: No MLL and 6 daily creel
- Supplemental stocking in the Black River Basin when surplus Interior Highlands Walleye fry are produced by Missouri hatcheries.

FUTURE GOALS

- Conserve the genetics of the Interior Highlands strain of Walleye in the Black River Basin
- Maintain these trophy Walleye fisheries that occur in Missouri and Arkansas.
- Determine best regulations to prevent the potential over-harvest of females and increase availability of male Walleye for harvest. Current female harvest rates may be impacting the population.
- Simplify and unify the regulations for this fishery in Missouri and Arkansas.
- Evaluate stock contribution using genetics.
- Determine if stocking is necessary to maintain the fishery in all rivers other than the upper St. Francis River, where natural recruitment is non-existent.

References
- Berkman, L.K.; Titus, C.L.; Thomas, D.R.; Fluker, B.L.; Cieslewicz, P.; Knuth, D.; Koppelman, J.B.; Eggert, L.S. Genetic Differences among the Interior Highlands Walleye (*Sander vitreus*) with Mitochondrial and Nuclear Markers Indicate the Need for Updated Stocking Practices. *Conserv. Genet* 2023, 24, 1-13.
- Cornforth A, Russell B, Settle R (2010) Black River Strain Walleye Final Report. Report to the Missouri Department of Conservation, Jefferson City, MO.

Wisconsin State Report submitted by Colin Dassow

1. **WDNR Hatchery Walleye Production**

   Hatchery walleye production numbers in 2024 associated with State of Wisconsin walleye stockings. These numbers include surplus fish sourced from our hatcheries, as well as fish the state purchased from vendors towards active work quotas. They do not include fish purchased from private funds, nor do they include independent tribal stockings.

   a. Fry Stocked = 29,712,307
   b. Small Fingerling = 738,776
   c. Large Fingerling = 456,794

2. **Walleye Angling Regulation Changes**

   2024 saw Wisconsin move from a base regulation walleye bag limit of 5/day to 3/day, with various length limit options. Now the standard highest bag limit per day allowed on Wisconsin walleye waters is 3/day. Additional bag limit options remain 1/day and catch and release only.

3. **WDNR Office of Applied Science Walleye Research**

NCD Walleye Technical Committee Wisconsin DNR Research Report – 2025

Submitted by Greg Sass, Fisheries Research Team Leader, Office of Applied Science

Diminishing productivity and hyperstable harvest in northern Wisconsin walleye fisheries (2024)

Mrnak, J.T., *Embke, H.S.*, ***Wilkinson, M.V.***, ***Shaw, S.L.***, *Vander Zanden, J.M. &* ***Sass, G.G.***

Key Findings:

- After analyzing 32 years of data from the Ceded Territory of Wisconsin, it was found that productivity decreases and sustained harvest rates may be jointly contributing to observed walleye declines

- Ceded Territory walleye lakes were classified into management groups of low, moderate or high vulnerability to harvest

- Harvest declines may help to maintain or increase the adaptive capacity of walleye in the Ceded Territory

Unraveling the ecological impacts of alewife in a large Midwest reservoir decades after introduction (2024)

Zebro, L. R., *Kreitman, J. W., Jonas, J. L.,* ***Sass, G. G.***, *Wuellner, M. R., & Koupal, K. D.*

Key Findings:

- Investigated the potential influences of alewife on the juvenile walleye population and zooplankton communities in Lake McConaughy, Nebraska, which was stocked with alewife in 1986

- There was no evidence of piscivory suggesting that alewife predation is not influencing walleye recruitment in Lake McConaughy

- Alewives almost exclusively consumed zooplankton throughout the study period, suggesting the potential for interspecific competition with young-of-year fish

Evaluating the potential importance of individual identity, maternal traits, and environment as predictors of egg characteristics in walleye Sander vitreus (2024)

Preul-Stimetz, T.N., S.L. Shaw, Z.S. Feiner, and G.G. Sass

Key Findings:

- Egg size was linked to environmental stochasticity and maternal size over time
- Fish identity was the strongest predictor of egg quality independent of other factors
- Implications for genetic drivers of egg quality influenced by climate variation

Lagging spawning and increasing phenological extremes jeopardize walleye (Sander vitreus) in north-temperate lakes (2024)

*Martha E. Barta, **Greg G. Sass**, Jeffrey R. Reed, Thomas A. Cichosz, Aaron D. Shultz, Mark Luehring, **Zachary S. Feiner***

Key Findings:

- This study assessed the spawning phenology of walleye in response to climate change
- Ice-off phenology shifted earlier, about 3x faster than walleye spawning phenology over time
- Spawning phenology deviations from historic averages increased in magnitude over time; large deviations were associated with poor offspring survival

Ongoing studies and updates

Whole-lake bullhead removal to test for walleye recruitment responses. In 2019, a whole-lake bullhead removal study was initiated on Howell Lake in Forest County, WI. After a year of baseline fish community monitoring in 2019, over 800,000 (adult and age-0) bullhead have been removed from Howell Lake. A review of previous bullhead removal studies in Wisconsin was published by Sikora et al. (2021) in a special issue of the North American Journal of Fisheries Management based on the 3rd International Catfish Symposium proceedings. Previous bullhead removals have shown major shifts in fish community structure favoring percids. Population demographics of bullhead in Howell Lake was also published in 2022. Post-bullhead removal fish community monitoring ended in 2024. Preliminarily, the bullhead removal resulted in a large year class of black crappie, high relative abundances of yellow perch, and walleye natural recruitment persists at low levels. This study will be written up for publication in spring 2025.

An ongoing project led by Zach Feiner is seeking to use walleye spawn timing to uncover critical periods for larval and juvenile walleye survival in Wisconsin lakes. Initial results suggest that temperature in the month before spawning is the dominant trigger for walleye spawning. Few clear critical periods for larval or juvenile walleye survival to the fall have been discovered, which may suggest that critical periods vary from year to year based on environmental conditions. Current findings suggest that day length may be a stronger predictor of spawn timing than water temperature. This research has been provisionally accepted in the Canadian Journal of Fisheries and Aquatic Sciences.

Restoring walleye populations in rainbow smelt invaded systems. In 2019, baseline research was conducted between UW-Madison, Center for Limnology Ph.D. student, Joe Mrnak, and WDNR fisheries research to restore walleye in a rainbow smelt dominated lake. Restoration is being attempted by stocking cisco and walleye, while subsequently removing rainbow smelt during spring spawning. This research is ongoing and cisco were stocked into

Sparkling and Crystal lakes in fall 2020 and 2021. Initial results from these manipulations suggest that rainbow smelt are at very low abundance in each lake and yellow perch and cisco and walleye, yellow perch, and cisco dominate the fish communities of Crystal and Sparkling lakes, respectively. This research will be published in an upcoming issue of Fisheries.

Mrnak, J.T., M.V. Wilkinson, L.W. Sikora, L. Feucht, A. Mrnak, M.J. Vander Zanden, and G.G. Sass. Invasive control and native restoration: directing ecosystem transformation through purposeful food web manipulations. Fisheries (in press).

Fish community productivity. Walleye production because of poor natural recruitment has declined over time in Ceded Territory of Wisconsin lakes. Determination of fish community production distribution in lakes with stable walleye natural recruitment versus those where natural recruitment has declined over time will be used to inform applied management actions to rebalance fish community production to favor walleye natural recruitment. A M.S. graduate student at UWSP (Max Wilkinson) will continue this study in 2023-2025.

Walleye Angler Effort Dynamics. The objectives of this FY24 SFR fisheries research project are: 1) test whether walleye angler effort has changed in the Ceded Territory of Wisconsin during 1990- 2025; 2) if walleye angler effect has changed in the Ceded Territory of Wisconsin over time, test whether angler effort has changed for other non-walleye sportfish over time; 3) test for predictors explaining variability in walleye and non-walleye sportfish angler effort dynamics over time; and 4) evaluate spatial and temporal dynamics of walleye and non-walleye sportfish angler effort dynamics in the Ceded Territory of Wisconsin over time. Given natural recruitment, adult abundance, and productivity declines in some Ceded Territory walleye populations, this project intends to better understand angler responses to declines in walleye productivity. Research is ongoing and preliminary results suggest that directed walleye angler effort has declined over timing and has tracked declines in adult walleye abundance. Angler effort for non-walleye species such as centrarchid panfish and bass has increased concomitant with declines in directed walleye angler effort.

Creel Survey Efficiencies. This FY24 SFR fisheries research project aims to identify potential efficiencies for existing point-intercept Wisconsin creel surveys. The project will examine long-term creel survey data to understand whether modeling may allow us to predict angler effort, catch rates, and harvest rates on more lakes with limited data. Further, the project aims to identify when species-specific creel surveys may be most important for estimating exploitation. The walleye portion of this project has been completed and will be written up for publication in spring 2025 with Colin Dassow as lead.

Using Structured Decision-Making and the Resist-Accept-Direct Climate Adaptation framework to inform Wisconsin walleye stocking decisions. A team of Wisconsin DNR, GLIFWC, and USGS scientists attended a formal workshop at the National Conservation Training Center in West Virginia in spring 2024 to use SDM and RAD to inform walleye stocking decisions in Wisconsin. The SDM/RAD exercise has been completed and results from this workshop are forthcoming after tribal member value discussions that will occur over the next year.

Poor recruitment paradigm for walleye. Bobby Davis, Joe Hennessy, and Greg Sass attended a poor recruitment paradigm workshop at the University of Minnesota-Twin Cities campus in November 2024. The poor recruitment paradigm identifies threshold predictors above or below which recruitment is always poor. Ceded Territory of Wisconsin walleye lakes, Escanaba Lake, and Lake Winnebago were the focus. Ice dynamics, flow, and temperature were generally the most robust predictors of walleye recruitment thresholds. Escanaba Lake and Lake Winnebago analyses are complete and write up for publication is ongoing.

Walleye rehabilitation synthesis. Characteristics of walleye rehabilitations and outcomes were synthesized over the last 50 years in the midwestern United States. Results suggested that common techniques for rehabilitating walleye natural recruitment were more successful in the past than currently. The synthesis offers pathways forward to increase the probability of walleye population rehabilitation success. This synthesis is provisionally accepted for publication in Reviews in Fisheries Science and Aquaculture.

Embke, H.S., Z.S. Feiner, G.J.A. Hansen, J.T. Mrnak, M. Price, C. Rounds, G.G. Sass, S.L. Shaw, and A.D. Shultz. Healing ogaa (walleye *Sander vitreus*) waters: lessons and future directions for inland fisheries rehabilitation. Reviews in Fisheries Science and Aquaculture (provisionally accepted).

Walleye Replacement Costs. Ongoing project using random forest models to project the probability of both the presence of adult walleye and successful natural recruitment in Wisconsin lakes. Using the model predictions the future cost of maintaining walleye fisheries in places that lose natural reproduction can be quantified. Alternatively, if stocking is not used to replace lost natural reproduction the increased travel cost for anglers to seek out a walleye fishing opportunity can also be quantified. The final manuscript for the project is in development.

4. **Great Lakes Indian Fish and Wildlife Commission**

Estimating the presence and abundance of beings in the lake through environmental DNA

Sampling Summary

GLIFWC collected eDNA samples from 10 lakes in the WI and MI Ceded Territories during September and October 2024. We used packets from Jonah Ventures to filter water from 5 sites in each lake. All of the lakes had fall surveys where all gamefish were collected. Nine out of the 10 lakes had walleye population estimates conducted in 2024. Filters were sent to the lab for analysis. The samples were analyzed using fish, phytoplankton, and other vertebrate metabarcoding panels. Some of the samples have been analyzed, while others are still at the lab awaiting analysis.

Initial Objectives

a. Do eDNA concentrations provide the same order of relative abundance as fall surveys?
b. Do eDNA concentrations relate to walleye density?
c. Is species richness as detected by eDNA highest at the outlet?
d. Does eDNA of any species relate closely to walleye abundance?
e. How much variance is occurring in eDNA samples of fish?

Next Steps

Once samples are finished being analyzed at the lab, they should be standardized based on the volume of water filtered. Then the analysis of the data to answer the objective questions can begin.

Hooking Mortality

The Anishinaabe philosophy emphasizes the responsibility to care for natural resources to ensure their sustainability for the next seven generations. However, Walleye (Ogaa) populations in the Ceded Territories are declining, partly due to rising water temperatures linked to climate change and indirect mortality from catch-and-release practices. In central Wisconsin, collaborative efforts between tribes and the state aim to manage ogaa populations, but existing regulations fail to address the impacts of post-release mortality.

This study investigates the relationship between angling practices and post-release mortality rates at different water temperatures. Preliminary results from the spring and fall of 2023 reveal that mortality rates significantly increase when water temperatures exceed 21.1 C, particularly for specific fish sizes. These findings are crucial for shaping future regulatory frameworks that consider the effects of climate change, ensuring the long-term viability of ogaa populations for future generations.

Ogaa Assisted Reproduction in Minocqua Lake

Lake Minocqua has shown a sustained decline in natural reproduction of Walleye. It is unknown what causes this blockage in natural reproduction, but the lake supports a healthy adult walleye population due to considerable stocking efforts and harvest restrictions. One proposed cause for the lack of natural reproduction is insufficient spawning habitat as a result of habitat degradation. Has sedimentation caused shallow, rocky shorelines on Minocqua to become less ideal for walleye spawning and/or survival of eggs/fry?

In efforts to address this question, we wondered if fertilized walleye eggs being deposited over an "ideal" sediment bed would result in more young surviving to their first fall. It is widely accepted that coarse gravel between 3-5" in diameter is the preferred spawning substrate. To test this, we made 12 wooden framed boxes with chicken-wire bottoms to use as the frame for our artificial gravel beds. Six of these boxes were designed with lids, made out of the same ½" chicken wire, in an effort to curb predation of fertilized eggs. Two predetermined locations (Fishers Island, Crescent Island) were host to these artificial gravel beds, six per location, three of each type (lid, no-lid).

At Least one female walleye was paired with 4-6 male walleyes per artificial spawning bed. A few of the beds were used for multiple treatments. Eggs were paired with milt in the boat, stirred, then released in the water, directly above the artificial gravel bed. Measures of both the volume of eggs and the volume of combined milt were taken. A total of 18 female walleye from Lake Minocqua had their eggs harvested and paired with milt, then dispersed over the treatment beds. Four additional female walleye had their eggs fertilized and deposited over existing in lake gravel beds. In total, 22 female and 124 male walleye were caught directly from Minocqua and were spawned with assistance. Fin clips were taken from every adult fish to be used as genetic markers in the case that juvenile Age-0 walleye were found during fall juvenile electroshocking assessments. Adult fish were caught using Fyke nets and electroshocking. Following approximately 30 days, the artificial spawning beds were removed from the lake. After that amount of time, the fertilized eggs should have hatched and the young should be free swimming.

Only one juvenile walleye was found during the fall juvenile walleye assessments conducted in October. A fin clip was taken from that fish to determine parentage, but it appears unlikely that assisted reproduction efforts were successful in 2024.

Estimating predation mortality of juvenile ogaawag in lakes with high and low predator burdens

Ogaawag (walleye Sander vitreus) declines in Mille Lacs Lake, MN, as well as other systems in the region, is often attributed to a bottleneck of low survivability of juvenile ogaawag from hatching to age-2 associated with environmental change. Juvenile ogaawag are also threatened with predation by ginoozhe (northern pike, Esox lucius), maashkinoozhe (muskellunge, Esox masquinongy), and even adult ogaawag. Because of its popularity and cultural significance, it is prudent to investigate these dynamics within Mille Lacs, but it is also important to focus upon smaller, more typical systems in the region.

We propose to tag age-1 ogaawag in Mille Lacs Lake as well as age-0 and age-1 ogaawag in two smaller lakes in the region with all studies to be conducted simultaneously. One of the additional lakes should have a strong predator population, such as Big Arbor Vitae, Vilas County, WI, while the other will not, such as Siskiwit Lake in Bayfield County, WI or Tamarack Lake in Gogebic County, MI. We propose to tag 30 juvenile ogaawag in Mille Lacs, as well as 30 age-0 and 30 age-1 ogaawag in each of the smaller lakes. To create a more complete picture of survival from hatching to age-2, we propose to tag a second round of 30 age-1 fish the following April to estimate survival over summer. Our objective with this study is to quantify the proportion of juvenile ogaawag that are consumed by predators, survive, or die by other means across a variety of systems. Comparing the proportion of tagged fish eaten, whose batteries run out, or die by other means across differing systems provides a model by which the predation dynamics within a lake may be approximated based upon its characteristics. The role that predation plays in the decline of ogaa populations has not been sufficiently studied, and findings can inform models and conservation efforts in the region.

5. **Green Bay Walleye Management Update**

A large reward tag study was initiated on lower Green Bay during the spring of 2024 with the goal of getting an estimate of the exploitation rate of adult walleyes. During the spring of 2024, a total of 4,535 walleyes were floy tagged including 202 that were tagged with reward tags. Reward tags were red and say "REWARD $100" on the tag. Walleyes were tagged in all known major spawning locations including the Fox River, Oconto River, Peshtigo River, Menominee River and Sturgeon Bay. Anglers who catch or harvest a walleye with a valid reward tag (the reward tags expire approximately 1 year after tagging and have a "Valid Until" date printed on the tag) and report that tag with proper confirmation (can present the physical tag or have picture evidence of the tag in a walleye and a verifiable tag number) will receive a $100.00 reward from Walleyes for Tomorrow. Anglers who report non-reward tags will receive a certificate that provides information about the tagging history of that fish. To date, only 158 tags have been reported including 8 reward tags. This reward tag project will run through at least 2026 and potentially longer depending on variability in estimates of exploitation and tag reporting rates during the first few years of the study. Estimates of angler exploitation with be used to guide future regulation changes for walleyes on the Green Bay system.

6. **Shawano Lake Movement Study**

Since 2011 – 221,167 Large Fingerling Walleyes have been stocked into Shawano, Loon and Washington Lakes. Large fingerling walleye stocked from our state hatcheries were marked with either a LV or RV clip from 2011 – 201l7. Walleyes for Tomorrow (WFT) has stocked over 43 million fry using a portable fish hatchery, into Shawano and Washington Lakes. Based on our comprehensive survey done in 2023 and our movement study in 2024 it is estimated that 34% of the population in the Shawano Lake system is made up of state hatchery fish. We have not documented natural reproduction in Shawano Lake since 2002. Based off of the 2016 YOY electrofishing surveys, all YOY captured in that particular survey originated from the portable hatchery.

In the spring of 2023 we were able to insert PIT tags into 811 walleye, 463 northern pike and 42 musky, while completing the comprehensive survey of Wolf River Pond, Outlet Channel, Shawano Lake, Washington Lake and Loon Lake. All of these waterbodies are connected and allow for movement of fish between one another. In February of 2024, 5 Litz cord and 6 submersible PIT tag arrays were deployed between different waterbodies and tributaries flowing into Shawano Lake and connected waters. The arrays were removed in June as the spawning window had passed for the three species that were being studied. The arrays that we had around the system had over 200,000 detections. These arrays or antennas have the ability to pick up older tags as well, since we have been PIT tagging muskies in Shawano Lake since 2008.

We were able to detect 313 walleye, 43 northern pike and 19 musky. What we found out was that nearly 1/3 of the walleye population in the Shawano Lake system is utilizing Loon and Washington Lakes and mostly Loon Creek between the two lakes as an area to spawn. We also found a smaller amount of walleyes traveling up Pickerel creek for spawning as well. There were historical reports of this taking place in the past, but it hasn't been assessed as an entire system in the past.

Most of DNR work looking at walleye spawning has taken place around Rosenows Point and Schumachers Island. These two places have smaller cobble and rock in Shawano Lake.

Interesting note is that if we handled those fish in Loon or Washington in the spring of 2023, 82% of those fish returned to their original tagging location. The females showed more site fidelity than the males, and the fish without clips or walleye wagon fish showed a higher site fidelity than the state hatchery raised fish.

For years it has been difficult to get an estimate on the size of the population. We net the spawning locations past the peak of the spawn and follow that up with electrofishing surveys to determine the percentage of fish that we had previously handled to come up with an estimate. With nearly a third of the population utilizing Loon Creek as a spawning location these fish are pretty much inaccessible to our electrofishing gear and we cannot get an accurate estimate of what is happening with the upper part of the system regarding walleye. We were able to see that spawning took place 4-5 days later in Loon and Pickerel creeks than on the Schumacher Island and Rosenows Point. When we did our recapture run with the electrofishing boat many of the fish were still in Loon Creek, but in order to accurately estimate Shawano itself we needed to electrofish the lake then. With this new information we can adjust our electrofishing runs to hopefully be able to get many of the fish coming back from Loon Creek. Essentially having to do two separate nights of electrofishing to target the different times of the spawning walleye as the waterbodies they are using are happening at different times.

Ongoing work will involve assessing habitat characteristics in the newly discovered spawning areas for walleye. Genetic testing to determine strains of walleye present in Shawano Lake and the connected waters. Also, genetic testing to determine whether YOY samples are from the WFT portable hatchery, state hatchery parents, or natural reproduction. Along with creating a different approach to sampling to get a better representation of the population of walleye within the entire Shawano Lake system.

7. **Molecular Conservation Genetics Laboratory**
    a. Recent vacancy that will be filled hopefully next year, not sure that the job announcement has even gone out yet
8. **Wisconsin Cooperative Fisheries Research Unit**

Wisconsin Cooperative Fishery Research Unit, University of Wisconsin-Stevens Point

Ongoing percid-focused projects:

Identifying walleye and lake whitefish spawning habitat below De Pere Dam to inform habitat improvements for lake sturgeon

Previous work indicates that lake sturgeon recruitment is extremely limited in the Fox River below De Pere Dam. Lack of available spawning habitat and the location of that habitat (nearshore) could contribute to low recruitment. Adding spawning habitat in the form of offshore reefs could provide a potential means to increase lake sturgeon recruitment. However, spawning habitat for other species must be considered in the planning process to ensure that restoration efforts for lake sturgeon do not result in loss of spawning habitat for other species. Specifically, the Fox River below De Pere supports significant spawning runs of native walleye (spring) and lake whitefish (fall) that contribute to important recreational and commercial fisheries in Green Bay. Specific spawning locations for walleye and lake whitefish in the Fox River remain unknown, but previous telemetry and available habitat suggest that many of these fish may spawn in the area shown on the map below. The goal of our project is to use intensive egg sampling to improve our understanding of where walleye and lake whitefish spawn in the Fox River below De Pere Dam to inform placement of the reef designed to improve lake sturgeon spawning habitat so that loss of spawning habitat for walleye and whitefish can be minimized. Project is led by M.S. student Braden Lensing.

Below is a list of percid-focused peer-reviewed publications and M.S. theses with 2024 publication dates:

Davis, R.P., L.M. Simmons, S.L. Shaw, G.G. Sass, N.M. Sard, D.A. Isermann, W.A. Larson, and J.J. Homola. 2024. Demographic patterns of walleye (Sander vitreus) reproductive success in a Wisconsin population. Evolutionary Applications 17:e13655. https://doi.org/10.1111/eva/13665.

Abstract: Harvest in walleye *Sander vitreus* fisheries is size-selective and could influence phenotypic traits of spawners; however, contributions of individual spawners to recruitment are unknown. We used parentage analyses using single nucleotide polymorphisms to test whether parental traits were related to the probability of offspring survival in Escanaba Lake, Wisconsin. From 2017 to 2020, 1339 adults and 1138 juveniles were genotyped and 66% of the offspring were assigned to at least one parent. Logistic regression indicated the probability of reproductive success (survival of age-0 to first fall) was positively (but weakly) related to total length and growth rate in females, but not age. No traits analyzed were related to reproductive success for males. Our analysis identified the model with the predictors' growth rate and year for females and the models with year and age and year for males as the most likely models to explain variation in reproductive success. Our findings indicate that interannual variation (i.e., environmental conditions) likely plays a key role in determining the probability of reproductive success in this population and provide limited support that female age, length, and growth rate influence recruitment.

Davis, R.P., and D.A. Isermann. 2024. Assessing factors related to walleye stocking success in the Midwestern United States. North American Journal of Fisheries Management 44:1008-1024.

Abstract: The objective of this study was to evaluate stocking success of Walleye *Sander vitreus* in lakes and reservoirs across the Midwestern United States to inform stocking practices for state agencies. Demand for Walleye stocking may increase if climate change limits the potential for natural recruitment in lakes. Consequently, the strategic distribution of Walleye stocking may maximize fishing opportunities. We synthesized data from 2226 Walleye fry and fingerling stocking events on 653 lakes in the Midwestern United States and used random forest algorithms and mixed-effects linear models to identify abiotic and biotic factors related to Walleye stocking success. Latitude and year explained relatively little variation in stocking success compared to within-lake variation. Relative abundance of Largemouth Bass *Micropterus nigricans* was an important indicator of Walleye stocking success for fry and fingerlings, with stocking success generally decreasing with increased bass abundance. There was an interaction between lake surface area and growing degree-days, as large lakes (>2500 ha) seemed to be more conducive to Walleye stocking success regardless of growing degree-days. The models that we developed did not accurately predict exact levels of Walleye stocking success but were 92–94% accurate in predicting whether the stocking success of both fry and fingerlings would be at or above the 50th percentile. These findings may help to inform the management and stocking allocation of Walleye and suggest that future increases in Largemouth Bass abundance and growing degree-days could limit the effectiveness of stocking in some lakes.

Dembkowski, D.J., A.W. Latzka, Z.S. Feiner, and D.A. Isermann. 2024. Use of vehicle counters to index and evaluate potential shifts in angler effort following implementation of more restrictive panfish regulations in Wisconsin lakes. North American Journal of Fisheries Management. https://doi.org/10.1002/nafm.11054.

Abstract: Understanding angler responses to fisheries management actions, such as regulation changes, has important implications for the effectiveness and efficacy of such management strategies. We examined whether vehicle counters could provide a relative index of angler effort, and we present a case study demonstrating use of vehicle counters to assess potential changes in angler effort associated with implementation of more restrictive panfish regulations in a subset of Wisconsin lakes. We compared vehicle counts with compulsory creel- and game-camera-based estimates of angler-hours and the number of angling parties. During 2016, a series of more restrictive panfish regulations were implemented across 132 Wisconsin lakes. We deployed vehicle counters at a subset of lakes within each regulation type during preregulation (2015–2016) and postregulation (2021–2022) time periods to assess whether the distribution of angler effort (as indexed using vehicle counters) among regulation types shifted in response to regulation implementation. At lakes with paired vehicle counters and compulsory creel data, vehicle counts explained 57–72% of the variation in daily angler effort (h) and 65–84% of the variation in daily number of angling parties. Across lakes with paired vehicle counters and game cameras, vehicle counters explained 63–77% of the variation in the number of apparent angling parties depending on how lakes were grouped (i.e., combined or stratified by regulation type); however, effectiveness of vehicle counters for explaining the variation in number of apparent angling parties varied at the individual lake level. We did not observe any systematic shifts in effort that would indicate a redistribution of angler effort in response to panfish regulations. Results suggest that given appropriate validation measures, vehicle counters could be used as a cost-effective tool to index angler effort. Our findings indicate that a localized scale for implementation of specialized regulations may be appropriate given angler behaviors and preferences for Wisconsin panfish.

Colborne, S.F., M.D. Faust, T.O. Brenden, T.A. Hayden, J.M. Robinson, T.M. MacDougall, H.A. Cook, D.A. Isermann, D.J. Dembkowski, M. Haffley, and C.S. Vandergoot. 2024. Estimating internal transmitter and external tag retention by

walleye in the Laurentian Great Lakes over multiple years. North American Journal of Fisheries Management 44:377-393.

Abstract: Both electronic tags (e.g., acoustic and radio transmitters) and conventional external tags are used to evaluate movement and population dynamics of fish. External tags are also sometimes used to facilitate the recovery of internal electronic tags or other instrumentation because healing can make it difficult to identify fish with internal tags based on appearance alone. With both tag types, tag shedding and failure of electronic tags can affect accuracy and precision of study results. We used a decade (2011–2021) of recapture data for Walleye *Sander vitreus* tagged in the Laurentian Great Lakes, where fish were double- or triple-tagged with external tags (T-bar, loop, or internal anchor tags) and internal acoustic transmitters, to quantify external tag and internal transmitter shedding and transmitter failure rates. In total, 1125 (33%) Walleye were recovered that had retained at least one external tag or internal transmitter. No confirmed cases of transmitter shedding were observed; 15 of 899 transmitters (2%) that were checked for functionality failed prior to the expected battery expiration. The retention of external T-bar tags 1 year after release differed depending on whether the tag was placed anterior or posterior to the secondary dorsal fin (anterior, fish length = 420 mm: 73% retention; anterior, fish length = 700 mm: 73%, posterior: 63%) but was <26% after 4 years for both tag positions and fish sizes. Internal anchor tags had an 88% 1-year retention probability and 81% 4-year retention probability. Loop tags had the highest 1-year retention (89%) but after 4 years retention (28–34% depending on agency) was comparable to that of T-bar tags. Better understanding of tag retention characteristics through long-term tagging studies such as this can inform study design, be considered in model design, and ultimately improve inferences from mark–recapture studies.

Vasquez, B.R. 2024. Evaluating walleye (Sander vitreus) thermal and optical habitat occupancy in northern Wisconsin lakes using two forms of technology. M.S. thesis, University of Wisconsin-Stevens Point.

Executive summary: Previous research suggests that walleye (Sander vitreus) fishery production is related to lake temperature and clarity. Based on this understanding, thermal (11–25°C) and optical (8–68 lumens/m2 , or lux) conditions presumed to be preferred by walleye were combined into lake area estimates of thermal-optical habitat area (TOHA; Lester et al. 2004), which served as a conceptualization of optimal habitat for walleye growth. There is substantial evidence that TOHA has decreased in some northern Midwest lakes, and that trends in walleye production and yield may be related to these shifts. However, no rigorous evaluation of walleye thermal-optical habitat occupancy exists and therefore it is unclear if walleye occupy optimal habitat as defined in the conceptual model. To assess the validity of TOHA, I tagged walleye with acoustic transmitters and archival tags that recorded high-frequency temperature and depth data. My objectives were to: 1) determine if walleye thermal and optical habitat occupancy varies among three northern Wisconsin lakes in relation to season and total length (TL); 2) determine if thermal and optical habitat boundaries employed in previous research are occupied by walleye; 3) redefine optimal walleye habitat using direct measurements of temperature, light, and dissolved oxygen (DO) occupancy; and 4) determine if data resolution and cost-effectiveness differs between two tags used to monitor walleye temperature occupancy.

In 2022, I surgically implanted acoustic transmitters and archival tags into walleye collected from Escanaba (n = 84), McDermott (n = 16; archival tags only), and Sparkling (n = 64) lakes and distributed these tags across three TL categories: small, 310–380 mm (n = 54); medium, 381–456 mm (n = 41); and large, ≥ 457 mm (n = 69). Each lake varied in regards to walleye recruitment status, stocking, morphometry, and temperature profiles. Most walleye were tagged during May 2022 during adult population surveys using fyke netting and nearshore night 4 electrofishing. Tags were inserted into the body cavity of walleye ≥ 310 mm with additional external tags to help identify tagged fish if recaptured or harvested. After initial tagging, acoustic receivers were deployed in Escanaba (n = 8) and Sparkling (n = 5) lakes to record observations from acoustic transmitters. During 2022, I opportunistically tagged additional walleye in June (McDermott Lake, n = 5) and September (Escanaba Lake, n = 7) to replace fish that were harvested by recreational anglers or tribal spearers from Escanaba Lake.

Temperature and light profiles used to characterize thermal and optical habitat were measured with strands of HOBO loggers deployed in the pelagic zone of each lake. These loggers recorded temperature and light intensity values every 10 min throughout the study. Weekly limnological measurements of water clarity and dissolved oxygen were also collected to complement HOBO logger data. I used these pelagic strands of loggers to determine the light experienced by a walleye at a specific depth through linear interpolation with walleye depth values. Additionally, walleye DO concentration at depth was determined with weekly profiles of dissolved oxygen and linear interpolation. As a post-hoc supplement to HOBO loggers in the pelagic zone of each lake, HOBO loggers were deployed in the littoral and pelagic zone of each lake during 2023 to address potential differences in thermal and optical conditions between these zones.

To address my objectives, I first tested for differences in temperature, depth, and light values of walleye across lakes and walleye TL categories using generalized additive mixedeffects models (GAMMs). I also determined if observed walleye temperature and light values aligned with thermal and optical habitat model ranges used in previous evaluations of TOHA by calculating occupancy within thermal and optical habitat when those habitats were available in each lake. Occupancy was calculated as the percent of observations that occurred within each 5 habitat range divided by the total number of observations. Additionally, occupancy rates were calculated by month (June, July, August, September, October) and time of day (dawn, day, dusk, night) to assess if occupancy varied in relation to these temporal categorizations. As an additional analysis, I calculated proportional benthic area (used in previous TOHA models) and average depth of thermal and optical habitat to examine trends in habitat availability across lakes. To redefine optimal walleye habitat, I calculated summary statistics, ecological niches, and habitat selection ratios for all walleye temperature, light, and DO observations. Last, to evaluate the cost efficiency and data resolution of both tag types deployed in Escanaba and Sparkling lakes, I created a cost-benefit analysis that included: 1) the number of individual fish providing data relative to number of tags released; 2) the total number of temperature observations obtained from each fish by tag type; 3) the average time between observations, 4) the total effort expended to collect and recover data, and 5) the total cost including effort-based costs. Data resolution metrics were only calculated for temperature sensors present in each tag type to reduce observation redundancy.

In 2023, walleye were recaptured during adult population estimates with fyke nets and electrofishing. In McDermott and Sparkling lakes, walleye with archival tags had tags surgically removed and were released alive. Walleye recaptured in Sparkling Lake with acoustic transmitters were released. All internally tagged walleye encountered on Escanaba Lake were euthanized for an ongoing exploitation experiment. Acoustic receiver detections were offloaded after walleye population estimates concluded. During this study, 176 individual walleye were tagged and viable data were recovered from 88 of these fish (50%). Analyses were conducted using dates ranging from 01 June to 31 October 2022 (i.e., days when thermal and optical habitat existed across study lakes). During this period, temperature and light profiles varied across lakes. 6 Additionally, when examining data from summer 2023, I found that temperatures in the littoral zone of each lake were comparable to those recorded in the pelagic zone but the pelagic zone was much brighter than the littoral zone.

GAMMs predicted that daily walleye temperature occupancy varied by lake and TL category. Walleye in Escanaba Lake ($\bar{x}$ = 19.4°C; N = 4,679) occupied slightly cooler water than McDermott Lake ($\bar{x}$ = 19.6°C; N = 739; $p < 0.01$), but walleye in Escanaba Lake and McDermott Lake occupied warmer water than Sparkling Lake ($\bar{x}$ = 18.2°C; N = 4,485; $p < 0.01$). Additionally, small ($\bar{x}$ = 19.2°C; N = 2,843) and medium ($\bar{x}$ = 19.4°C; N = 2,723) walleye used similar temperatures but large walleye were in slightly cooler water than small walleye ($\bar{x}$ = 18.4°C; N = 4,337; $p = 0.02$). Daily averages predicted that walleye in Sparkling Lake ($\bar{x}$ = 4.59 m; N = 4,434) occupied deeper water than walleye in Escanaba ($\bar{x}$ = 2.01 m; N = 4,355) and McDermott lakes ($\bar{x}$ = 2.44 m; N = 739, $p < 0.01$). In contrast to the depth results, mean daily light (excluding night and square-root transformed for residuals to meet Gaussian distribution) predicted that lake and TL category were not sufficient at describing interpolated walleye light occupancy. When evaluating occupancy in thermal habitat, I found that walleye were generally within 11–25°C (95.6% of observations) as long as it was available. In stark contrast, I found that walleye were rarely within optical habitat (6.4% of observations) and most observations occurred at thousands of lux higher than the optical habitat range (8–68 lux). Occupancy in 8–68 lux only increased when optical habitat availability increased in shallower water (i.e., during dawn and dusk). The metrics I used to redefine the thermal boundary of TOHA suggested that 20–23°C are the most preferred temperatures when available. However, these metrics were unable provide agreement on a preferred light range for light values; regardless, all metrics suggested that 8–68 lux was too limited of a range to serve as a landscape-scale characterization 7 of preferred walleye habitat. To improve the TOHA framework, I also calculated DO occupancy rates and found that concentrations ≥ 7 mg/L were preferred. My tag cost-benefit analysis suggested that archival tags collected more data at a lower cost than acoustic transmitters, largely because of high recapture rates across all three study lakes.

These results suggest that walleye ≥ 310 mm prefer similar temperatures and dissolved oxygen concentrations among lakes. Because I found no evidence of selection for a certain light range, I suggest removing light from estimates of TOHA and instead using Secchi depth (1–3 m Secchi depth, reported across multiple studies as being optimal for walleye populations) as a landscape-scale predictor. Additionally, truncating thermal habitat from 11–25°C to 20–23°C and adding dissolved oxygen concentrations ≥ 7 mg/L may explain variation in walleye production or abundance better than previous

TOHA models. Furthermore, my tag analysis suggested that archival tags and acoustic transmitters are both adequate at collecting temperature data on fish in inland lakes, but cost efficiency is highly dependent on fish recovery rate. Improvement of the TOHA conceptual model could aid walleye management, and my cost-benefit analysis of tag types may help agency personnel choose a tagging technology for future research projects.

No reports submitted from ON, SK, MB, or AB Canada.