North Central Division of the American Fisheries Society

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

3:00 – 5:00 PM (CST), Sunday, February 13, 2022
In association with the Midwest Fish & Wildlife Conference (Des Moines, IA)
In-Person & Virtual Zoom Meeting

WTC Chair: Lawrence Eslinger, lawrence.eslinger@wisconsin.gov
WTC Chair-elect: Jason DeBoer, jadeboer@illinois.edu
WTC Immediate past-chair: Mark Ermer, Mark.Ermer@state.sd.us
WTC Secretary: Dave Seibel, david.seibel@wisconsin.gov
ETC Chair: Addie Dutton, DuttonA@michigan.gov
CTC Chair: BJ Schall, Benjamin.Schall@state.sd.us

Approved Meeting Minutes

1. **Call Meeting to Order** – Meeting called to order by Lawrence Eslinger at 3:05 CT

   Introductions – Virtual members went around and introduced themselves and their affiliation followed by the in-person attendees. About 30 attendees.

2. **Agenda Additions and Approval**

   No additions recommended. Jason DeBoer made a motion to approve the agenda. Second by John Bruner.

3. **Approve Minutes from 2021 Virtual Summer Joint Meeting (emailed out prior to this meeting)**

   Motion made to approve the 2021 minutes by Jason DeBoer. Second by Bill Gardner.

4. **2022 Summer Meeting: July 18-21, Kemp Natural Resources Station, Woodruff, WI**

   Lawrence mentioned that due to agency COVID policy limitations and our associated timeline that it was not in the best interest of our groups to try to host the summer meeting at Kemp Natural Resources Station in Woodruff, WI (due to a relatively high risk of the meeting having to be cancelled again). He asked if anyone else would be willing to host the 2022 summer meeting. Jason clarified that we are looking for the option of someone else hosting the meeting or to hold the meeting virtual as was done in 2021. It was brought up that the incoming chair typically hosts the meeting in their state. Jason offered to explore options in Illinois but would likely be in a larger urban location such as Peoria, IL. Jonathan Meerbeek (IA) mentioned that the Lakeside Laboratory near Okoboji would be a good option as it was hosted there in the past. Support for this was displayed by other Iowa members present and Nebraska members. It was mentioned that anyone else with ideas can forward them to

Jason and Lawrence, and that they would communicate final summer meeting details as soon as possible.

a. Continuing Education Course Ideas

Lawrence mentioned the idea of a course around the theme of assessing habitat. Dan Isermann identified that the course could be set up similar to the presentations given at Mille Lacs, MN, due to a hands-on approach being difficult to conduct. Any other ideas can be brought up to Jason or Lawrence. Mark Fincel announced that there are funds available through NCD Continuing Education committee that can be used if there was a need.

5. Percid Travel Award

This year there were three applications for the Percid Travel Award, and the winner was Kyle Olivencia from Iowa State University. Lawrence read a biography and M.S. project description for Kyle, and Kyle is presenting his work at the ongoing Midwest Fish and Wildlife Conference. All three applications were close with all candidates being deserving of the award. Kyle will receive the $200 Percid award, along with another $200 award to be matched by the Iowa AFS subunit. Kyle will also be sent a copy of Biology, Management, and Culture of Walleye and Sauger (Barton 2011), and John Bruner also contributed a copy of his new book Yellow Perch, Walleye, and Sauger: Aspects of Ecology, Management, and Culture (Bruner and DeBruyne 2021) to Kyle as well.

6. Break-out for CTC, ETC, and WTC Meetings

The CTC and ETC broke out into their own business meetings with the WTC continuing in the room.

7. WTC State and Provincial Reports

State reports were submitted from Illinois, Iowa, Nebraska, Minnesota, North Dakota, South Dakota, and Wisconsin. State representatives provided some updates and remarks for their respective states. Full state reports are incorporated at the end of these meeting minutes.

Jason DeBoer didn't have much to add to this submitted report but offered to respond to any questions about the submitted report. He stressed the additional information that he included from Mike Garthaus with IDNR, who is proud of the opportunities that are provided on the smaller waters.

Andy Jansen provided a summary of his submitted Iowa report. He mentioned that Iowa is evaluating stocking success in pond stocked versus Recirculating Aquaculture System (RAS) stocked walleye fingerlings. They also evaluated their captive walleye brood stock and are looking at lake versus river walleye genetics.

Mark Fincel asked how the RAS is doing and Lewis mentioned that it is going well but having some limited success in return after stocked in the lakes. He also mentioned that that fish from the RAS system have some deformities.

Joe Rydell provided a short comment about the report submitted on Nebraska emphasizing the 2021 walleye production was back to normal and continuing research on Lake McConaughy, NE.

Mark Fincel highlighted some of the projects continuing in South Dakota that was written in his report which includes a jaw tagging project going on the Missouri River reservoirs. South Dakota is also working on stocking evaluations and a new telemetry project tracking walleye and sauger through the Missouri River reservoirs got started in 2021.

Lawrence Eslinger highlighted some items from the Wisconsin report. The statewide walleye management plan is being updated for the first time since 1997; stakeholder meetings were held virtually. The WI Walleye Initiative that began in 2013 is now entering the evaluation stage of the project which will occur over the next 5 or so years. This project will evaluate survival of extended growth walleye fingerlings (6-8 in.) stocked at several different rates as well as their contribution to the adult population.

Dale Logsdon and Brian Nerbonne from Minnesota provided an update. University of Minnesota is doing research on system changes specifically looking at zebra mussel introductions on young-of-the-year walleye. One item of interest was the increase in mercury concentrations in adult walleye as a result of zebra mussel introductions.

Ed Roseman and Jason Gostiaux provided an update for Michigan. They mentioned that a PDF of the state management plan is available, and the state is using a suitability index model for stocking and managing walleye. It was mentioned that a change in the Saginaw Bay walleye season will occur this spring opening up the corridor area to walleye harvest.

8. WTC Treasurer's Report by Dave Seibel

a. WTC general/operating fund (expenses, deposits, and balances for calendar year) – Dave Seibel was not in attendance, so Lawrence presented Dave's report noting that NCD Sec./Treas. Drew Holloway does an exceptional job of keeping track of our finances. Ending general fund balance was $21,525.58, which included a number of deposits towards the Percid Symposium publication effort. Subtracting out the Percid Symposium contributions leaves a net general fund balance of $5,975.58.
b. WTC AFS Investment Account – Investments have increased from the $5,000 originally invested in 2018 plus $2,500 added in 2019 to an end of 2021 second quarter balance of $10,139.
c. Percid Symposium NAJFM publication financial contributions – Contributions towards the Percid Symposium publication total $15,550 to date. The NCD has also committed up to $5,000 in additional funding if needed. The goal of WTC is to cover as much of the authors' publication costs as possible, especially for authors without dedicated funding.

9. Old Business WTC

a. 2021 National AFS Updates – Mark Fincel provided a quick update. Maryland was a small meeting but a good one. He gave a shout out to Rebecca for her symposium running very smoothly.

b. Bruner, John Clay, and DeBruyne, Robin L. (editors). 2021. Yellow Perch, Walleye, and Sauger: Aspects of Ecology, Management, and Culture. Springer Cham, Switzerland, Fish & Fisheries Series Vol. 41:1-328 pp. Number of Illustrations 41 b/w illustrations, 47 illustrations in color.

John Bruner gave an update on his book. So far have sold 683 copies. Some of the first copies produced in the US were misprinted and the owners can get a new copy by contacting Springer Publishing.

c. 2021 MWFWC Percid Symposium Updates & Plans Going Forward

1. Financial Info – Contact with National AFS/Wiley for author publishing costs

Lawrence and Dan Isermann talked about the status of the Percid Symposium publication (upcoming special section in NAJFM). Total publishing costs have been estimated by AFS for approx. $27,000, but some contributing authors do not need financial assistance. Dan is working to determine the final associated publishing costs for only the authors that need funding, and that with the committed NCD support (up to $5,000), WTC should be able to cover the necessary costs (see 3. below).

2. AFS Education Committee Proposal Status – Lawrence identified that WTC's proposal to the Ed. Comm. for $4,000 in support of the Percid Symposium publication was approved and awarded to WTC. Thanks were extended to Jason and Mark Fincel for help with advancing that proposal

3. NCD Approved Contribution Status (up to $5,000) – Lawrence will be providing an update during tomorrow's NCD annual business meeting that details the information in 9c1. WTC will get in touch with NCD ExComm when a final dollar amount necessary to satisfy publishing costs is determined.

d. Possible student travel award to present at the Percis-V conference in Ceske Budejovice, Czech Republic, Sept. 18-23, 2022.

John Bruner brought up at the summer meeting about providing a travel award to a student to attend and present at the Percis-V conference in Czech Republic in September of 2022. John proposed that the award be set at $1,500, which he estimated would cover approximately 60% of the associated travel costs to attend the meeting. It was noted that the early registration and abstract deadline is March 31, 2022 with a late registration cutoff date of August 15, 2022.

Ed Roseman mentioned that the Percis-V conference is currently an in-person meeting only but may change due to uncertainties regarding COVID and current political tensions in eastern Europe. Details mentioned of the event included, 5 keynote speakers expected to attend and that the European Union was a big financial supporter. Ed was also going to look into the publication to see if papers not presented at the conference could be submitted for the publication.

Lawrence Eslinger reached out all three of the Percid Travel Award applicants, and two responded with some potential interest, but uncertainty as well. It was identified that this possible Percis-V travel award opportunity was identified within the call for Percid Travel Award applications.

Mark Fincel asked if we approved funding for the event at the summer meeting. It was answered that no motion for funding was made during the summer meeting, so the item was not voted on or approved. However, the topic was moved to be discussed at this winter meeting.

Lawrence mentioned concern due to the ongoing eastern European activities (Russian advancement towards Ukraine), COVID uncertainty, the lukewarm response from students, and the short time frame between now and the March deadline for early registration.

Jason DeBoer mentioned that we would need time to review applications for the award, and Lawrence mentioned that it was discussed during the Summer meeting to award one of the applicants of the Percid Travel Award to negate the need for readvertising (hence the reasoning for identifying this possible opportunity in the Percid Award call for applications).

Mark Fincel mentioned that it didn't make sense that we only offered one Percid Travel Award for $200 and not award two other applicants to come to our local meeting but would spend up to $1,500 to send one student to the Percis-V meeting.

Rebecca Krogman suggested that the award could additionally send a WTC early professional member as well, especially if there was little interest from students.

Ed Roseman mentioned that social media might be a good way to advertise for the award and that he would be willing to volunteer coordinate that application process.

John Bruner made the motion for the WTC to issue a $1,500 travel award to a student or young professional to attend and present at the Percis-V symposium. Bill Gardner seconded. Lawrence then called the In-person and virtual attendees to a vote, where 8 voted for, 8 voted against, and the rest abstained. Due to the tied vote and difficulty of counting votes virtually and in-person, a second "roll-call" vote was conducted. The "roll-call" vote read, 8 for, 8 against, 4 abstain, and 1 no vote (AFS membership lapsed). Motion failed.

Jason DeBoer asked if there was interest to discuss the Percid Travel Award to open more opportunity for students to attend and present at the Midwest Fish & Wildlife Conference Meeting. The topic was decided to be revisited at the upcoming summer meeting.

e. Possible Midwest Walleye Stocking Success Project

Dan Isermann and student "Bobby" gave a brief update to the study. There are 10 states involved in the study and so far six have sent in some data with 4 states sending in complete data sets. The purpose of the study is to determine what factors affect stocking success to provide a guide for managers in the future. A presentation on the project will be given at the MWFWC meeting on Tuesday.

10. New business WTC

a. Installment of new WTC chair, Jason DeBoer, and recognition of outgoing chair, Lawrence Eslinger. Jason accepted the responsibility and took over the meeting from this point.

b. Installment of new WTC secretary/treasurer, Joe Rydell, and recognition of outgoing sec./treas., Dave Seibel. Joe accepted the responsibility and thanked Dave and Lawrence for great leadership during COVID times.

11. Adjourn

Dan Isermann motioned to adjourn and Daniel Dembkowski seconded.

State reports received for the Winter Meeting are posted below.

IL WTC Report, February 2022, submitted by Jason DeBoer INHS

Qihong Dai and Cory Suski, University of Illinois

We are doing work looking at how short-duration heat waves impact predator-prey dynamics in agricultural streams. We are testing that given the same thermal stress, whether cool water species like walleye will experience more impacts compared to warm water species like largemouth bass, based on results of metabolism and swimming performance. Also, whether walleye will show less predation capacity on fathead minnow compared to largemouth bass.

Jeremiah Haas, Exelon

As far as walleye production and stocking, we had a nice year. April collections were ridiculous in terms of size and numbers. It is scary how strong the fishery is locally. We stocked 241,109 2"-5" fish in Pool 13 (60,942), Pool 14 (175,849), and in Lost Grove Lake (4,026), near Princeton, Iowa. The Lost Grove fish were near the end of season and were larger fish. Our fall mark/recapture of branded YOY fish on the Miss. was very high. Initially, it looks like mother nature had a poor year of production in 2021. We had the first year of normal water levels during fall sampling in quite a while, so we'll see if that had anything to do with it too. Our samples of larger fish was significantly lower too. Most of the fish were out on the main channel border where the electrofishing boat isn't all that effective, however fishing poles still were.

We are still scheduled to install a new recirculating system for walleye production, similar to Rathbun Hatchery, hopefully in January. This will allow us to discontinue using the spray canal for fish production and give us better production controls in the future.

Ben Lubinski, Illinois DNR

16,747 sauger were stocked into the lower Kaskaskia River in June of 2021.

Seth Love, Illinois DNR

Heidecke Lake: While not a formal evaluation, 68 Walleye ranging from 14 to 26 inches were collected from Heidecke Lake during the Spring Muskie trap netting survey. Heidecke Lake supports a healthy Walleye population in large part due to a substantial Gizzard Shad forage base.

Chaminwood Lake: Due to COVID-19, Saugeye stocking at Chaminwood Lake could not take place until this year (2021). Chaminwood Lake is a former quarry lake located in suburban Will County. Formal Saugeye evaluations will take place in the coming seasons.

Blake Ruebush, Illinois DNR

Pittsfield City Lake, Pike County – On 5/25/2021, 13,110 1.5" Walleye were stocked. Historically stocked annually.

SchuyRush Lake, Schuyler County – On 6/8/2021 19,357 2.1" Saugeye were stocked. New stocking in 2021.

Siloam Springs Lake, Adams County – On 5/25/2021, 3,565 1.5" Walleye were stocked. New stocking in 2021.

Luke Nelson, Illinois DNR

Devil's Kitchen Lake (an 810-acre lake in Crab Orchard National Wildlife Refuge) has maintained a small population of yellow perch for over 60 years. These fish were believed to be stocked in a contaminated load of

smallmouth bass upon the lake's completion in the late 1950's, and they've shown up in spring electrofishing samples off and on since 2000. Stocking efforts were started in 2014 to supplement the small amount of natural recruitment, with 52,735 1.5" fingerlings stocked in 2021. Stocking rates are high because of the presence of a severely crowded and stunted largemouth bass population. We've sampled small numbers of desirable sized (9"-nearly 11") yellow perch in Devil's Kitchen in 2019 and 2021, and anglers have begun reporting incidental catches of "eater sized" fish as well. Stocking will continue if fingerlings are available from the USFWS system, especially if angler interest continues to grow.

Tristan Widloe, Illinois DNR

Sixty-four walleye broodfish were collected from the Kankakee River below the Wilmington Dam via DC-boat electrofishing on March 25-26, 2021; 59 of which were transferred to the LaSalle Hatchery. Electrofishing catch rate was 60 walleye/hour. Average length of broodstock was 466 mm (18 in). The largest walleye collected was a female measuring 644 mm (25 in).

Three locations on the Kankakee River (Aroma Park, downstream Kankakee Dam, and downstream Wilmington Dam) were stocked with 129,220 fingerling walleye in 2021.

Nick Abell, Illinois DNR

Initial stockings of Saugeye occurred at two strip mine lakes (Green Wing Lake and Mallard Lake) within Pyramid State Park in Perry County during 2021. Prior to 2021, Green Wing Lake (40 acres) had been stocked annually with Walleye since 2002. Mallard Lake (65 acres) was stocked with Walleye during 2019 and 2020. The literature suggests that Saugeye may be a better option than Walleye for stocking in these relatively small lakes. Night electrofishing surveys were conducted during Fall of 2021 to evaluate the development of the Walleye/Sauegeye fishery in each lake. No targeted surveys had been conducted for these species prior to 2021.

No Walleye or Saugeye were collected during the Fall survey at Green Wing Lake. However, angler reports and catches during past community surveys indicate that Walleye do recruit in Green Wing Lake and can be targeted. In contrast to Green Wing Lake, the Fall survey at Mallard Lake produced catch rates of 20 Saugeye (YOY) per hour and 12 Walleye (2019 & 2020 year classes) per hour. YOY Saugeye in the sample were generally 7-8 inches in length, while Walleye ranged from 12 to over 18 inches in length. The fishery in Mallard Lake seems to be developing quite well. Targeted surveys for Walleye/Saugeye will be repeated annually at each lake to monitor these fisheries as Saugeye begin to gradually replace Walleye.

Mike Garthaus, Illinois DNR

ILLINOIS DEPARTMENT
OF NATURAL RESOURCES
DIVISION OF FISHERIES

SUPPLEMENTAL SURVEY

COUNTY: McLean
T 23N R 4E S 26 & 35
Direction from nearest town:
3 miles N and 2 mi E of LeRoy

Date of Inspection: 3/22/21

Name of Water: Dawson Lake Owner: State of Illinois
Address: Moraine View State Park Phone: 309/724-8032
R.R. 2 LeRoy, IL 61752
Person Contacted Mark Hahn Identification Site Sup.
Address Phone
Water Classification: State XX Public ___ Organizational
Commercial ___ Private ___ Stream

Survey Initiated By: District Fisheries Biologist
Water Size: 158 Acres or ___ Miles.
Date of Last Inspection: 10/28/20
Purpose of Survey: Saugeye Survey

The lake was divided into three sampling areas. Each area was sampled at night for 20 minutes using DC electrofishing.

Saugeye were collected and two netters were utilized during the survey.
Historical night surveys have been conducted in fall at Dawson Lake. This survey was conducted in March to see if spring sampling would increase the catch rates of larger Saugeye.

Regulation

Walleye/Saugeye – 15 inch minimum length limit with no more than 1 fish greater than or equal to 20 inches; 3 fish daily harvest limit – April 2016.

Saugeye

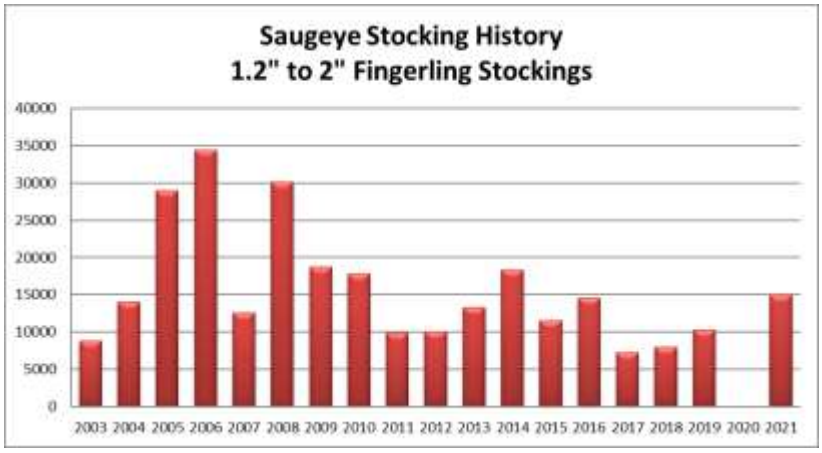
In 2003, the Walleye stocking was changed to a Saugeye stocking in an attempt to decrease the density of the sunfish population without overpopulating the bass population. The increase in the number of predators in the lake should reduce the number of sunfish in the lake. The Saugeye were also stocked to help improve the Black Crappie fishery. The increased predation on Black Crappie was expected to increase the size structure of the Black Crappie population. Shad became established in Dawson Lake in 2018 and will change the dynamics of the fish community.

Lynch, Jr. et.al. (1982) found that Saugeye utilized Green Sunfish and Bluegill as forage and suggested that Saugeye would feed and grow in impoundments with Centrarchid prey. Preliminary research comparing Saugeye and Walleye in reservoirs indicates Saugeye is more littoral in nature, feeding on a wide variety of prey including Centrarchids (Carline and Johnson 1980). Galin et. al. (2002) found that Black Crappie composed a large portion of the diet for all Saugeye length groups during summer and fall. Moreover, Saugeye predation on small Black Crappie resulted in a reduction in abundance, which led to the density-dependent increase in growth for the crappie.

As of now, there is no indication the Saugeye are impacting the bluegill or crappie fishery. However, the Saugeye are providing a great bonus fishery to Dawson Lake.

<u>Stocking</u>

Due to Covid-19 restrictions in 2020, no saugeye were stocked. The requested stocking rate is 7,110 2-inch saugeye per year.



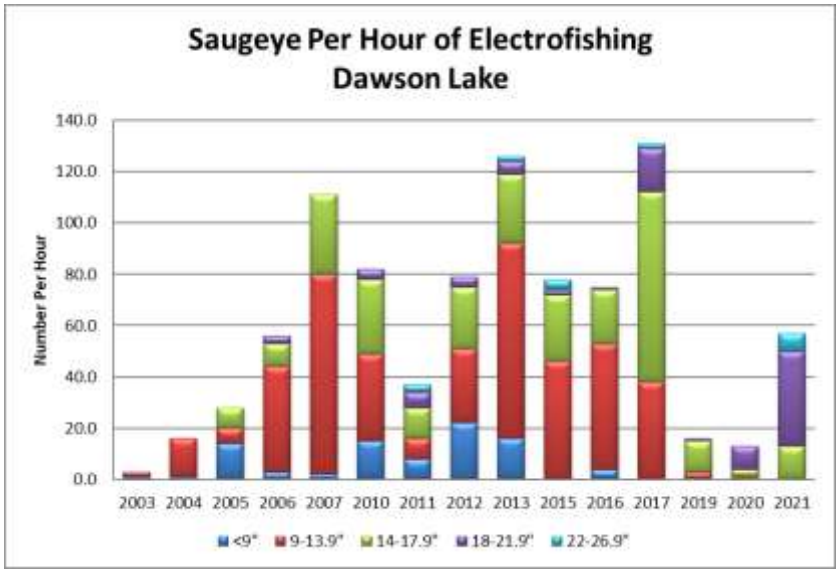
Density and Size Structure

From 2003 to 2020 the targeted night survey was conducted in the fall. This survey provided useful information about the smaller Saugeye in the fishery but appeared to underestimate the number of larger Saugeye in the fishery. In 2021, a targeted night survey was completed in March to determine if a spring survey would improve the catch rate of larger Saugeye.

The average catch rate for Saugeye over 18" during the fall survey is 4.5 per hour. The catch rate for Saugeye over 18" in the spring survey was 43 saugeye per hour and was well above the highest catch of 19 per hour for a fall survey.

Since there was no 2020 stocking, there is no way to determine if the spring survey is a good time to evaluate the smaller Saugeye in the fishery. Hopefully, future surveys will show that spring surveys will provide information for all sizes of Saugeye.

Saugeye were kept during the 2019 spring frame netting survey for age and growth analysis. The 2019 fall survey indicated that density was poor. In past fall surveys, higher catch rates have been from Saugeye less than 14 inches. Even if the removal of Saugeye for age and growth analysis negatively impacted overall density, it should have rebounded quickly with a strong 2019 year class. The 2019 fall survey failed to collect substock sized Saugeye and only one stock sized Saugeye. This might indicate the 2019 year class had poor survival. The spring 2021 survey resulted in a high catch rate of larger Saugeye and the 2021 stocking will hopefully rebuild the number of smaller Saugeye in the fishery.



In 2021, proportional stock density was 100 and exceeded the management objective of 40 to 60. Relative stock density (RSD-460) was 77 and the RSD-560 was 12. Size structure indices are elevated because no stock sized Saugeye were collected. However, the spring surveys appears to be a better season to target larger Saugeye.

Condition

The average relative weight was 104. Relative weight values are higher in the spring due to increase in gonadal weights. Also, shad were found in Dawson Lake in 2018 and in large numbers since then. The added forage has improved condition of Saugeye during other seasons.

MANAGEMENT RECOMMENDATIONS

1. Continue requesting 7,110 2-inch Saugeye in the lake.
2. Conduct night survey for Saugeye in the spring of 2022.

Literature Cited

Carline, R.F. and B.L. Johnson. 1980. Evaluation of saugeye stocking in selected Ohio lakes. Ohio Department of Natural Resource, Division of Wildlife, Annual Performance Report, Federal Aid Project F-57-R, Colombus, Ohio, USA.

Jackson, J.J. and K.L. Hurley. 2005. Relative Growth of White Crappie and Black Crappie in the United States. Journal of Freshwater Ecology, Vol. 20, Number 3, Sept 2005.

Jynch Jr., W.E., D.L. Johnson, S.A. Schell. 1982. Survival, Growth, and Food Habits of Walleye x Sauger Hybrids (Saugeye) in Ponds. North American Journal of Fisheries Management 4:381-387,1982.

Table 1. Catch rate, size structure and relative weights for saugeye.

SPECIES: SAUGEYE
LAKE: DAWSON LAKE
COUNTY: MCLEAN
ACRES: 159
GEAR: ELECTROFISHING - NIGHT SURVEY

YEAR	TOTAL NUMBER AND CPE			<S <230 <9"	S-Q 230-349 9-13.9"	Q-P 350-459 14-17.9"	P-M 460-559 18-21.9"	M-T 560-689 22-26.9"	>T >690 >27"	Relative Weight: Average Relative Weight	Relative Weight: S-Q 230-349 9-13.9"	Relative Weight: Q-P 350-459 14-17.9"	Relative Weight: P-M 460-559 18-21.9"	Relative Weight: M-T 560-690 22-26.9"	PSD	RSD-P	RSD-M	EFFORT
2003	NO.=	3		1	2	0	0	0	0	82	82				0	0	0	1
	CPE=	3.0		1.0	2.0	0.0	0.0	0.0										
	%			33	67	0	0	0										
2004	NO.=	16		1	15	0	0	0	0	84	84				0	0	0	1
	CPE=	16.0		1.0	15.0	0.0	0.0	0.0	0.0									
	%			6	94	0	0	0	0									
2005	NO.=	28		14	6	8	0	0	0	86	93	83			57	0	0	1
	CPE=	28.0		14.0	6.0	8.0	0.0	0.0	0.0									
	%			50	21	29	0	0	0									
2006	NO.=	56		3	41	9	3	0	0	97	99	91	91		23	6	0	1
	CPE=	56.0		3.0	41.0	9.0	3.0	0.0	0.0									
	%			5	73	16	5	0	0									
2007	NO.=	111		2	78	31	0	0	0	86	88	85			28	0	0	1
	CPE=	111.0		2.0	78.0	31.0	0.0	0.0	0.0									
	%			2	70	28	0	0	0									
2010	NO.=	82		15	34	29	4	0	0	91	97	89	80		49	6	0	1
	CPE=	82.0		15.0	34.0	29.0	4.0	0.0										
	%			18	41	35	5	0										
2011	NO.=	37		8	8	12	6	3	0	83	79	82	87	84	72	31	10	1
	CPE=	37.0		8.0	8.0	12.0	6.0	3.0										
	%			22	22	32	16	8										
2012	NO.=	79		22	29	24	4	0	0	92	94	92	86		49	7	0	1
	CPE=	79.0		22.0	29.0	24.0	4.0	0.0										
	%			28	37	30	5	0										
2013	NO.=	126		16	76	27	5	2	0	89	89	90	90	91	31	6	2	1
	CPE=	126.0		16.0	76.0	27.0	5.0	2.0										
	%			13	60	21	4	2										
2015	NO.=	78		0	46	26	2	4	0	84	84	84	85	82	41	8	5	1
	CPE=	78.0		0.0	46.0	26.0	2.0	4.0	0.0									
	%			0	59	33	3	5	0									
2016	NO.=	75		4	49	21	1	0	0	83	84	80	80		31	1	0	1
	CPE=	75.0		4.0	49.0	21.0	1.0	0.0										
	%			5	65	28	1	0										
2017	NO.=	131		0	38	74	17	2	0	87	94	85	81	89	71	15	2	1
	CPE=	131.0		0.0	38.0	74.0	17.0	2.0										
	%			0	29	56	13	2										
2019	NO.=	16		0	3	12	1	0	0	86	88	87	75		81	6	0	1
	CPE=	16.0		0.0	3.0	12.0	1.0	0.0	0.0									
	%			0	19	75	6	0	0									
2020	NO.=	13		0	1	3	9	0	0	99	116	98	97		92	69	0	1
	CPE=	13.0		0.0	1.0	3.0	9.0	0.0	0.0									
	%			0	8	23	69	0	0									
2021	NO.=	57		0	0	13	37	7	0	104		103	103	109	100	77	12	1
	CPE=	57.0		0.0	0.0	13.0	37.0	7.0	0.0									
	%			0	0	23	65	12	0									
Average		60.5		5.7	28.4	19.3	5.9	1.2	0.0	88.8	90.8	88.4	86.8	91.0	48.4	15.5	2.1	

2003-2020:Fall
2021 Spring

ILLINOIS DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISHERIES

SUPPLEMENTAL SURVEY

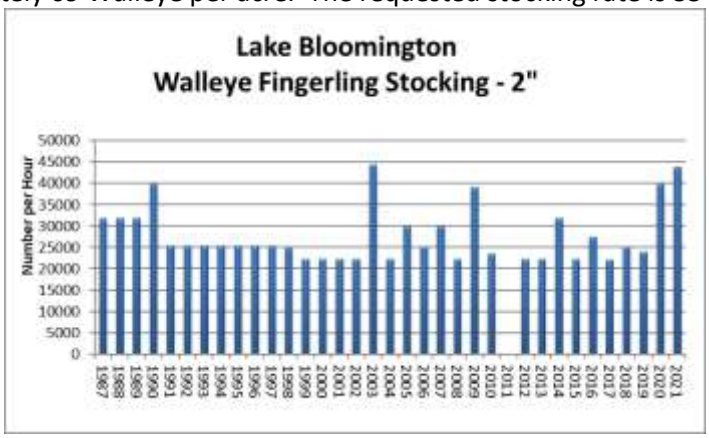
Name of Water: Lake Bloomington
Water Size: 635 Acres
Purpose of Survey: Walleye survey
Date of Inspection:24 March 2021
Date of Last Inspection: 23 October 2017

On 24 March 2021, a night survey was conducted using DC electrofishing. The lake was divided into 3 stations and

surveyed for a total of 60 minutes. Two netters were utilized during the survey.

Stocking

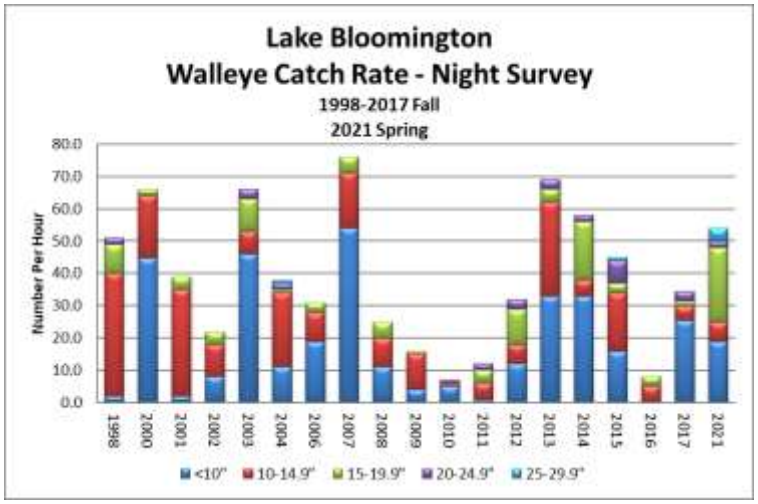
Walleye were first stocked by IDNR in 1984 and on a regular basis starting in 1986. From 1998 to 2006, 8" walleye were stocked from a private hatchery. In 2021, the State Hatchery System stocked 43,926 1.6" Walleye, which is a stocking rate of approximately 69 Walleye per acre. The requested stocking rate is 35 per acre.



Density and Size Structure

From 1998 to 2017 the targeted Walleye surveys were completed in the fall. These surveys were initially completed to evaluate the success of the Walleye stocking program. The fall surveys provide a great picture of smaller Walleye in the fishery but fail to collect good numbers of larger Walleye.

In 2021, the targeted survey was completed in March and the survey resulted in a better overall picture of the Walleye fishery than the fall surveys. The survey collected Walleye from 6 inches to 27 inches. The catch rate of Walleye for the 2021 spring survey was 54 Walleye per hour. Fall surveys have had higher catch rates but those surveys were dominated by YOY Walleye.



Of the walleye collected over 10 inches in 2021, 83% were over 15 inches and 17% were over 20 inches. The 2021 survey resulted in the highest catch rate for Walleye over 15 inches. Lake Bloomington has a quality Walleye fishery.

A new walleye regulation was implemented April 1, 2017. The new regulation is an 18 inch minimum length limit and a 3 per day harvest limit. Without previous spring surveys, it is difficult to determine if the increase in catch rate of larger Walleye is due to an improvement in the fishery or due to the timing of the survey. Moving the survey to the spring had the desired result of increasing the catch rate of larger Walleye. Future spring surveys will help assess the new Walleye regulation.

Condition

Condition has been below the management objective of 95 to 105 for all fall surveys but the objective was met for the 2021 spring survey. The higher weights in spring are probably due to increased gonadal weight, but the drop in weight during the summer could be due to a decrease in feeding during the heat of the summer.

Recommendations:

1. Stock 22,225 two-inch Walleye.
2. Conduct a survey in Spring 2022 for Walleye.

Catch rates, relative weight, and structural indices for Walleye.

SPECIES: WALLEYE
LAKE: LAKE BLOOMINGTON
COUNTY: MCLEAN
ACRES: 635
GEAR: ELECTROFISHING - NIGHT

YEAR	TOTAL NUMBER AND CPE		≥ 18" 460mm	<S <250 <10"	S-Q 250-379 10-14.9"	Q-P 380-509 15-19.9"	P-M 510-629 20-24.9"	M-T 630-759 25-29.9"	Relative Weight Mean Wr	Relative Weight S-Q 250-379 10-14.9"	Relative Weight Q-P 380-509 15-19.9"	Relative Weight P-M 510-629 20-24.9"	Relative Weight M-T 630-759 25-29.9"	PSD	RSD-P	RSD-M	EFFORT
1998	NO.=	51		2	38	9	2	0									
	CPE=	51.0		2.0	38.0	9.0	2.0	0.0		86	86	86		22	4	0	1
	%			4	75	18	4	0									
2000	NO.=	68		46	20	2	0	0									
	CPE=	66.0		44.7	19.4	1.9	0.0	0.0		87	86			9	0	0	1.03
	%			68	29	3	0	0									
2001	NO.=	39		2	33	4	0	0									
	CPE=	39.0		2.0	33.0	4.0	0.0	0.0		86	79			11	0	0	1
	%			5	85	10	0	0									
2002	NO.=	11		4	5	2	0	0									
	CPE=	22.0		8.0	10.0	4.0	0.0	0.0		76	99			29	0	0	0.5
	%			36	45	18	0	0									
2003	NO.=	66		46	7	10	3	0									
	CPE=	66.0		46.0	7.0	10.0	3.0	0.0						65	15	0	1
	%			70	11	15	5	0									
2004	NO.=	38		11	23	1	2	1									
	CPE=	38.0		11.0	23.0	1.0	2.0	1.0		82	84	82	88	15	11	4	1
	%			29	61	3	5	3									
2006	NO.=	31		19	9	3	0	0									
	CPE=	31.0		19.0	9.0	3.0	0.0	0.0		87	85			25	0	0	1
	%			61	29	10	0	0									
2007	NO.=	76		54	17	5	0	0									
	CPE=	76.0		54.0	17.0	5.0	0.0	0.0		83	85			23	0	0	1
	%			71	22	7	0	0									
2008	NO.=	25		11	9	5	0	0									
	CPE=	25.0		11.0	9.0	5.0	0.0	0.0		80	80			36	0	0	1
	%			44	36	20	0	0									
2009	NO.=	16		4	11	1	0	0									
	CPE=	16.0		4.0	11.0	1.0	0.0	0.0		84	78			8	0	0	1
	%			25	69	6	0	0									
2010	NO.=	7		5	1	0	1	0									
	CPE=	7.0		5.0	1.0	0.0	1.0	0.0		86		78		50	50	0	1
	%			71	14	0	14	0									
2011	NO.=	12		1	5	4	2	0									
	CPE=	12.0		1.0	5.0	4.0	2.0	0.0		83	83	78		55	18	0	1
	%			8	42	33	17	0									
2012	NO.=	32		12	6	11	3	0									
	CPE=	32.0		12.0	6.0	11.0	3.0	0.0		91	87	93		70	15	0	1
	%			38	19	34	9	0									
2013	NO.=	69		33	29	4	3	0									
	CPE=	69.0		33.0	29.0	4.0	3.0	0.0		87	89	95		19	8	0	1
	%			48	42	6	4	0									
2014	NO.=	58		33	5	18	2	0									
	CPE=	58.0		33.0	5.0	18.0	2.0	0.0		86	84	83		80	8	0	1
	%			57	9	31	3	0									
2015	NO.=	45		16	18	3	7	1									
	CPE=	45.0		16.0	18.0	3.0	7.0	1.0		85	90	93	99	38	28	3	1
	%			36	40	7	16	2									
2016	NO.=	8		0	5	3	0	0									
	CPE=	8.0		0.0	5.0	3.0	0.0	0.0		85	81			38	0	0	1
	%			0	63	38	0	0									
2017	NO.=	23		17	3	1	2	0									
	CPE=	34.3		25.4	4.5	1.5	3.0	0.0		85	86	89		50	33	0	0.67
	%			74	13	4	9	0									
2021	NO.=	54	9	19	6	23	2	4									
	CPE=	54.0	9.0	19.0	6.0	23.0	2.0	4.0		98	96	105	108	83	17	11	1
	%			35	11	43	4	7									
Average		39.4		18.2	13.5	5.9	1.6	0.3		85.4	85.8	88.2	98.2	38.1	10.9	1.0	

2004:Low Water Levels-Work on Retention Wall at Water Plant.
1998 to 2017 Fall Surveys
2021 Spring Survey

ILLINOIS DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISHERIES

SUPPLEMENTAL SURVEY

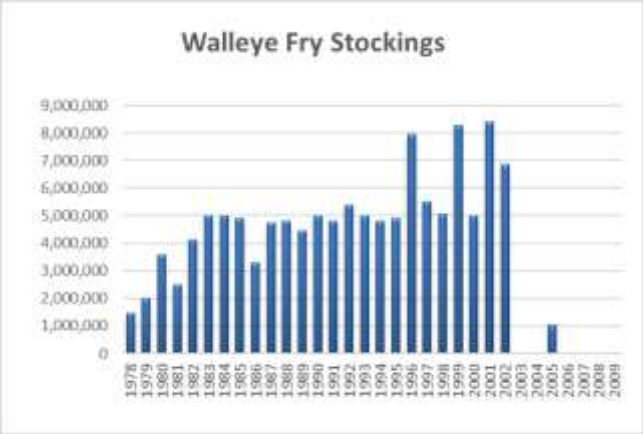
Name of Water: Clinton Lake

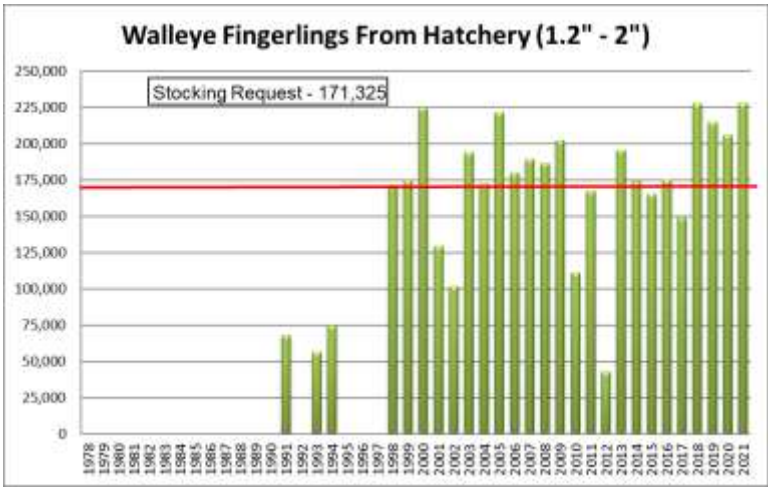
Water Classification: State
Water Size: 4895 Acres

Date of Inspection: April 6, 2021
Date of Last Inspection: October 26, 2015
Purpose of Survey: Walleye Survey

Stocking

Walleye were first stocked into Clinton Lake when the lake was completed in 1978. The Walleye stocking program initially stocked fry and then switched mainly to fingerlings in 1998. The annual stocking request for Clinton Lake is 171,325 Walleye fingerlings, which is a stocking rate of 35 per acre. Walleye have been stocked in recent years at the West Side Boat Ramp that is near the dam. Clinton Lake is a nuclear power cooling lake and water temperatures are near ambient water temperatures at this boat ramp. In 2021, the stocking location was moved upstream to the North Fork Boat Ramp to move the Walleye away from the Dam and stock them in one of the coolest parts of the lake.





Surveys

Periodic assessment of the walleye fishery has taken place at Clinton Lake, but no standardized survey has been established. A community survey is conducted each fall and the fishery has been assessed using this data. Catch rates are low during the community survey, so a standardized survey needs to be established to assess the Walleye fishery.

The community surveys have 12 to 14 sampling stations sampled each fall using DC electrofishing. Three-phase AC electrofishing was used until 2011 and each station was sampled for 1 hour. Effort was reduced to 45 minutes per station in 2013 and then reduced to 15 minutes in 2018. The reduction in effort has impacted the total number of Walleye collected but catch rates have not been much different. High catch rates in 2013 and 2015 have impacted the average catch rate since switching to DC surveys.

The reduction in the total number of Walleye collected during the community survey has increased the need for a targeted Walleye survey.

SPECIES: WALLEYE
LAKE: CLINTON LAKE
COUNTY: DEWITT
ACRES: 4895
GEAR: ELECTROFISHING

YEAR	TOTAL NUMBER AND CPE		Length Limit >460mm >18"	<S <250 <10"	S-Q 250-379 10-14.9"	Q-P 380-509 15-19.9"	P-M 510-629 20-24.9"	M-T 630-759 25-29.9"	>T >760 >30"	PSD	RSD-P	RSD-M	EFFORT	Relative Weight S-Q 250-379 10-14.9"	Q-P 380-509 15-19.9"	P-M 510-629 20-24.9"	M-T 630-759 25-29.9"	Avg. Wr
2011	NO.=	80		21	3	17	27	12										
	CPE=	6.8		1.8	0.3	1.5	2.3	1.0	0.0	95	66	20.3	11.7	88	80	80	80	80
	%			26	4	21	34	15	0									
2012	NO.=	46		2	7	14	18	5										
	CPE=	3.8		0.2	0.6	1.2	1.5	0.4	0.0	84	52	11.4	12	86	84	84	83	84
	%			4	15	30	39	11	0									
2013	NO.=	100		32	12	21	29	6										
	CPE=	11.1		3.6	1.3	2.3	3.2	0.7	0.0	82	51	8.8	9					83
	%			32	12	21	29	6	0									
2014	NO.=	26		7	5	9	4	1										
	CPE=	2.9		0.8	0.6	1.0	0.4	0.1	0.0	74	26	5.3	9	88	88	97	85	90
	%			27	19	35	15	4	0									
2015	NO.=	87		5	4	25	50	3										
	CPE=	9.7		0.6	0.4	2.8	5.6	0.3	0.0	95	65	3.7	9	85	84	86	82	85
	%			6	5	29	57	3	0									
2016	NO.=	19		0	5	4	10	0	0									
	CPE=	2.4		0.0	0.6	0.5	1.3	0.0	0.0	74	53	0.0	8	84	83	81		82
	%			0	26	21	53	0	0									
2017	NO.=	34		1	20	7	6	0	0									
	CPE=	4.3		0.1	2.5	0.9	0.8	0.0	0.0	39	18	0.0	8	92	80	77	80	80
	%			3	59	21	18	0	0									
2018	NO.=	8	4	1	2	2	3	0	0									
	CPE=	2.7	1.3	0.3	0.7	0.7	1.0	0.0	0.0	71	43	0.0	3	80	83	75		78
	%		50	13	25	25	38	0	0									
2019	NO.=	9	6	0	1	3	5	0	0									
	CPE=	2.6	1.7	0.0	0.3	0.9	1.4	0.0	0.0	89	56	0.0	3.5	81	85	79		81
	%		67	0	11	33	56	0	0									
2020	NO.=	11	1	4	2	4	1	0	0									
	CPE=	3.1	0.3	1.1	0.6	1.1	0.3	0.0	0.0	71	14	0.0	3.5	81	85	83		83
	%		9	36	18	36	9	0	0									
Average	2011 to present	4.9	1.1	0.8	0.8	1.3	1.8	0.3	0.0	77.5	44.4	4.9	7.7	85.0	83.6	82.4	82.0	82.6

Figure 1. Fall Community Survey Data

On October 26, 2015, three, 30-minute electrofishing runs were completed during the day to assess the Walleye fishery. This survey was completed to establish sampling sites for targeted Walleye surveys. Sampling sites were FS1, FS2, and FS3 and are shown on the sampling map below. A total of 17 Walleye were collected ranging in size from 208mm to 617mm. The largest Walleye weighed 5.74 pounds. Unfortunately, this survey resulted in low catch rates and resources were used at other lakes for future targeted Walleye and Saugeye surveys.

SPECIES: WALLEYE
LAKE: CLINTON LAKE
COUNTY: DEWITT
ACRES: 4895
GEAR: DC ELECTROFISHING - Fall, Day

YEAR	TOTAL NUMBER AND CPE		Length Limit >350mm >14"	<S <250 <10"	S-Q 250-379 10-14.9"	Q-P 380-509 15-19.9"	P-M 510-629 20-24.9"	M-T 630-759 25-29.9"	>T >760 >30"	PSD	RSD-P	RSD-M	EFFORT	Relative Weight S-Q 250-379 10-14.9"	Q-P 380-509 15-19.9"	P-M 510-629 20-24.9"	M-T 630-759 25-29.9"	Avg. Wr
2015	NO.=	17		1	0	2	14	0	0									
	CPE=	11.3		0.7	0.0	1.3	9.3	0.0	0.0	100	88	0.0	1.5		83	89		88
	%			6	0	12	82	0	0									

Figure 2. Fall, Day Targeted Walleye Survey

On April 6, 2021 a night survey using DC electrofishing was conducted for 1 hour. Two, 30-minute sites were sampled and are shown on the sampling map below as NS1 and NS2. Sampling site NS2 continues into sampling site FS3 on the dam. The sites chosen in 2021 were shallow flats near deeper water. The catch rates for each of the sampling sites used in the 2015 and 2021 targeted surveys are similar. It was hoped that there were areas of the lake where higher concentrations of Walleye could be targeted. It appears the distribution of Walleye is relatively uniform on the west side of the lake.

Station	Walleye Collected
FS1	4
FS2	8
FS3	5
NS1	11
NS2	6

Figure 3. Number of Walleye Collected Per Site

The survey completed in 2015 was dominated by Walleye over 20 inches and the 2021 survey resulted in no Walleye being collected over 15 inches. It was encouraging to see smaller Walleye in the 2021 survey and hopefully they

will be able to build the Walleye fishery.

Periodic high-water events in recent years are believed to be responsible for losing larger Walleye over the dam. Anglers have been reported catching Walleye in the spillway area.

Future targeted surveys will be conducted at night and in the spring, and new sampling sites will be used in conjunction with historical sampling sites. Since the stocking location was changed in 2021, at least one site will be near the new stocking location.

SPECIES: WALLEYE
LAKE: CLINTON LAKE
COUNTY: DEWITT
ACRES: 4895
GEAR: DC ELECTROFISHING - Spring, Night

YEAR	TOTAL NUMBER AND CPE			<S <250 <10"	S-Q 250-379 10-14.9"	Q-P 380-509 15-19.9"	P-M 510-629 20-24.9"	M-T 630-759 25-29.9"	>T >760 >30"	PSD	RSD-P	RSD-M	EFFORT	Relative Weight S-Q 250-379 10-14.9"	Q-P 380-509 15-19.9"	P-M 510-629 20-24.9"	M-T 630-759 25-29.9"	Avg. Wr
2021	NO.=	17		13	4	0	0	0	0									
	CPE=	17.0		13.0	4.0	0.0	0.0	0.0	0.0	0	0	0.0	1	96				
	%			76	24	0	0	0	0									

Figure 4. Spring, Night Targeted Walleye Survey

Figure 5. Sampling Map

ILLINOIS DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISHERIES

SUPPLEMENTAL SURVEY

Date of Inspection: 4/1/21

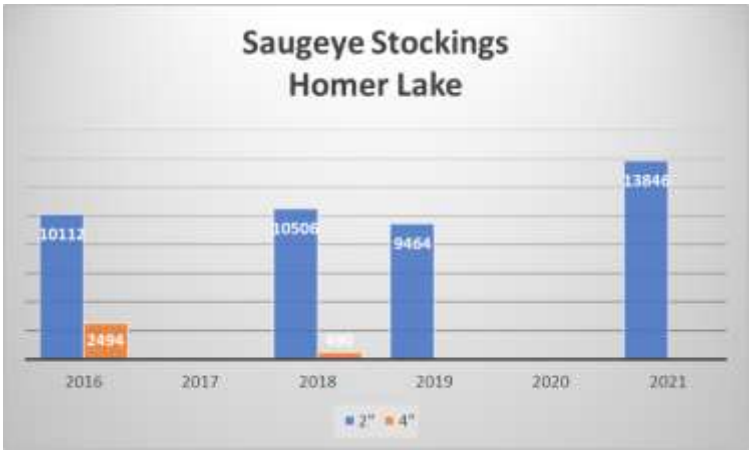
FISH MANAGER: **Mike Garthaus**
LAKE NAME: **Homer Lake** COUNTY: **Champaign** WATER NO: **337**
OWNERSHIP (STATE, PUB-CO, PUB-OT): **Pub-Co** ACREAGE: **80.8**

REGULATION: **Statewide; 14” minimum length limit, 6 per day harvest limit.**

In 2019, the lake was surveyed using three, 20-minute DC electrofishing stations. This was the first night survey conducted at Homer Lake. Two netters were utilized during the survey.
In 2021, the Saugeye targeted survey was conducted in April using 2, 20-minute DC electrofishing stations and two netters were used during the survey.

Saugeye

Saugeye were first stocked into Homer Lake in 2016. The Saugeye stockings were initiated to provide a bonus fishery at Homer Lake and provide additional predation on panfish. The annual stocking request is 7,272 2” fingerlings, which is a stocking rate of 90 per acre. A high stocking rate was selected to account for potential higher predation at stocking due to the small size of the water.



Density and Size Structure

A catch rate of 14 saugeye per hour was obtained in 2019. Approximately 64% of the saugeye collected were less than 9 inches. This hopefully represents a strong year class and will lead to a quality fishery. One saugeye over 18 inches was collected and would have been from the 2016 stockings.
A catch rate of 18 Saugeye per hour was obtained in the 2021 spring survey. No saugeye were collected in station NS1 during the 2021 survey. Almost all the Saugeye were collected towards the end of Station NS2 in shallow water. All but one Saugeye collected were male.
The majority of the Saugeye collected, 75 percent, were larger than 14 inches. There was a shift from smaller Saugeye being collected in the fall survey to the spring survey. This is a normal pattern between fall and spring surveys.
No Saugeye less than 9 inches were collected in 2021 and is due to no Saugeye stocking in 2020. The large 2021 Saugeye stocking will hopefully contribute to building a quality Saugeye fishery. Higher catch rates are needed to create a quality fishery. Spillway escapement is a concern at Homer Lake.

SPECIES: SAUGEYE
LAKE: HOMER LAKE
COUNTY: CHAMPAIGN
ACRES: 80
GEAR: Spring, DC - Night survey

										Relative Weight								
YEAR	TOTAL NUMBER AND CPE			<S <230 <9"	S-Q 230-349 9-13.9"	Q-P 350-459 14-17.9"	P-M 460-559 18-21.9"	M-T 560-689 22-26.9"	>T >690 >27"	Average Relative Weight	S-Q 230-349 9-13.9"	Q-P 350-459 14-17.9"	P-M 460-559 18-21.9"	M-T 560-690 22-26.9"	PSD	RSD-P	RSD-M	EFFORT
2019	NO.=	14		9	2	2	1	0	0	85	89	81	85		60	20	0	1
	CPE=	14.0		9.0	2.0	2.0	1.0	0.0	0.0									
	%			64	14	14	7	0	0									
2021	NO.=	12		0	3	6	3	0	0	101	104	102	95		75	25	0	0.666
	CPE=	18.0		0.0	4.5	9.0	4.5	0.0	0.0									
	%			0	25	50	25	0	0									

2019 - Fall Survey

Condition

Condition, based on relative weight, was great during the spring survey. It is normal to see condition decline in the fall survey. Higher gonadal weight increases relative weight values in the spring.

Future Management

Saugeye will continue to be stocked each year and a spring night survey will be completed in 2023.

Figure 6 Spring Sampling Map

ILLINOIS DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISHERIES

SUPPLEMENTAL SURVEY

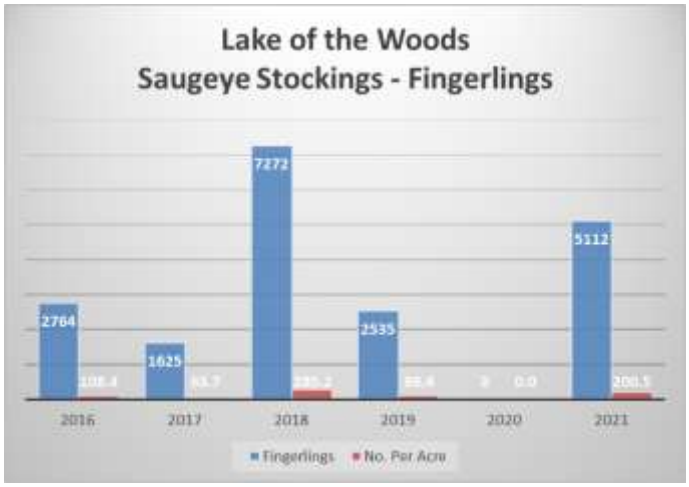
Date of Inspection: 3/29/21

FISH MANAGER: **Mike Garthaus**
LAKE NAME: Lake of the Woods COUNTY: **Champaign**
OWNERSHIP (STATE, PUB-CO, PUB-OT): **Pub-Co** ACREAGE: **25.5**
REGULATION: **Statewide; 14" minimum length limit, 6 per day harvest limit.**

The lake was surveyed using three DC electrofishing stations. Two stations were sampled for 15 minutes each and a third site was sampled for 10 minutes. This was the first night survey conducted at Lake of the Woods. Two netters were utilized during the survey.

Saugeye

Saugeye were first stocked into Lake of the Woods in 2016. The Saugeye stockings were initiated to provide a bonus fishery at Lake of the Woods and provide additional predation on panfish. The annual stocking request is 2,550 2" fingerlings, which is a stocking rate of 100 per acre. A high stocking rate was selected to account for potential higher predation at stocking due to the small size of the water. In most years, the number of Saugeye stocked is well above the requested rate. In 2019, there were an additional 158,000 Saugeye fry stocked into Lake of the Woods.



Density and Size Structure

A catch rate of 157.7 Saugeye per hour was obtained in the 2021 spring survey. No Saugeye less than 9 inches were collected in 2021 and is due to no Saugeye stocking in 2020. Approximately 83% of the Saugeye collected were larger than the 14-inch minimum length limit. No Saugeye were collected over 18 inches, but there is a chance they are in the lake. Growth rates are assumed to be below average due to the high catch rate and low condition in the spring. Density is high but the majority of the Saugeye are available for harvest.

SPECIES: SAUGEYE
LAKE: LAKE OF THE WOODS
COUNTY: CHAMPAIGN
ACRES: 25.5
GEAR: ELECTROFISHING

YEAR	TOTAL NUMBER AND CPE			<S <9"	S-Q 230-349 9-13.9"	Q-P 350-459 14-17.9"	P-M 460-559 18-21.9"	M-T 560-689 22-26.9"	>T >690 >27"	Relative Weight: Average Relative Weight	Relative Weight: S-Q 230-349 9-13.9"	Relative Weight: Q-P 350-459 14-17.9"	Relative Weight: P-M 460-559 18-21.9"	Relative Weight: M-T 560-690 22-26.9"	PSD	RSD-P	RSD-M	EFFORT
2021	NO.=	105		0	18	87	0	0	0		90	89			83	0	0	0.666
	CPE=	157.7		0.0	27.0	130.6	0.0	0.0	0.0									
	%			0	17	83	0	0	0									
Avg.																		

Condition

Condition, based on relative weight, was low during the spring survey. We usually see higher gonadal weight increasing relative weight values in the spring.

Future Management

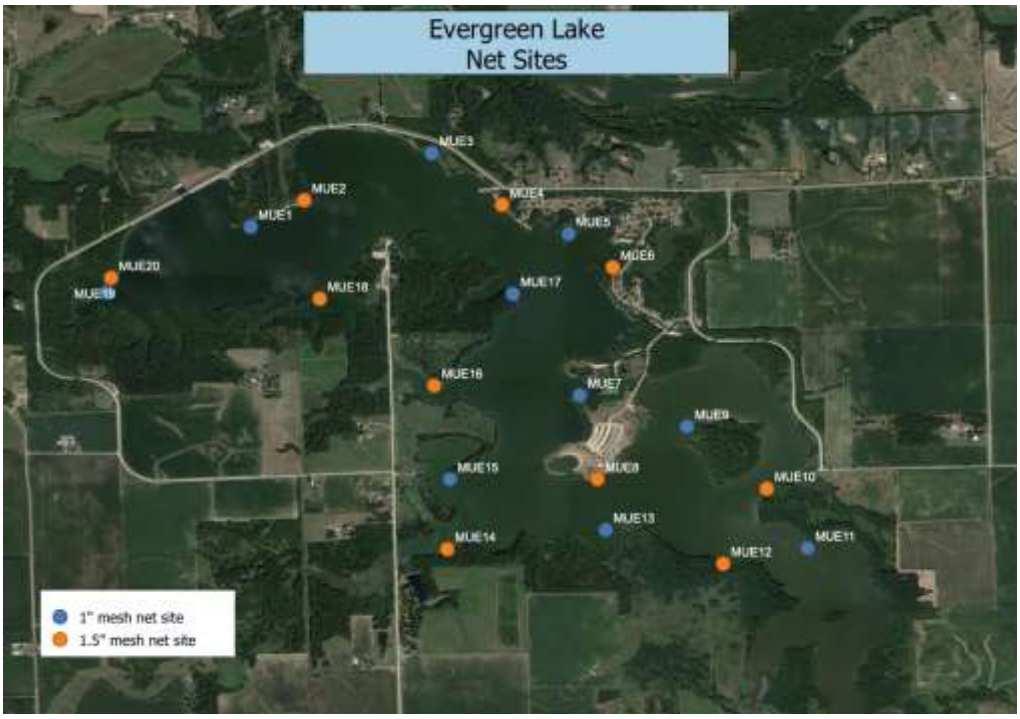
Saugeye will continue to be stocked each year and a spring night survey will be completed in 2023.

Figure 7 Spring Sampling Map

ILLINOIS DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISHERIES
SUPPLEMENTAL SURVEY

Evergreen Lake
Owner: City of Bloomington
Lessee: McLean County Parks and Recreation
Water Classification: Public Coop
Water Size: 926 acres
Date of Inspection: 3/30&31/21
Purpose of Survey: Saugeye survey

Two different fyke net designs were used during the 2021fyke netting survey. The 1” mesh fyke nets were 4' x 6' with 2 frames per net followed by (n = 5) 36” diameter hoops, and 1 throat on first hoop. The 1.5” mesh fyke nets were 4’ x 6’ with 2 frames per net followed by (n=6) 30” diameter hoops, and 2 throats. Ten nets of each type were run for two net-nights totaling 40 net-nights of effort. Frame nets were first utilized in 2002 to assess these fisheries. The standard net size for this survey has been the 1.5” mesh fyke net.



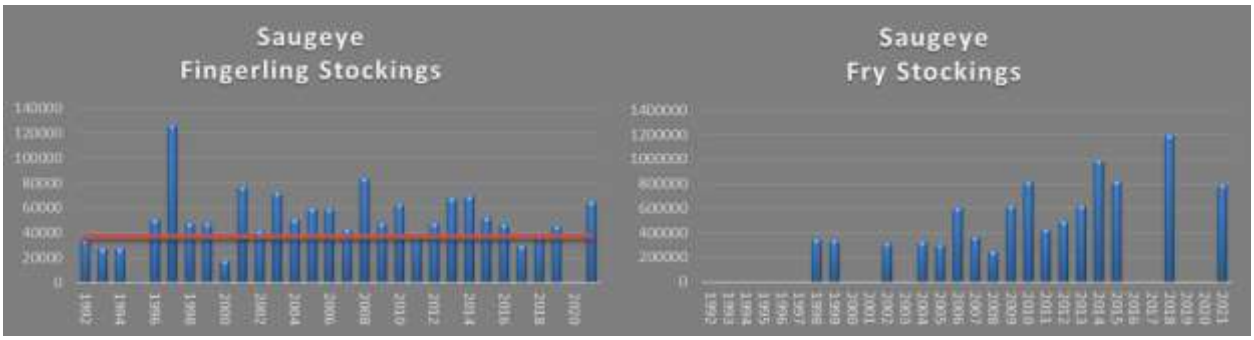
Regulations

Saugeye 18" minimum length limit and 3 per day harvest limit. (April 1, 2015)

Saugeye

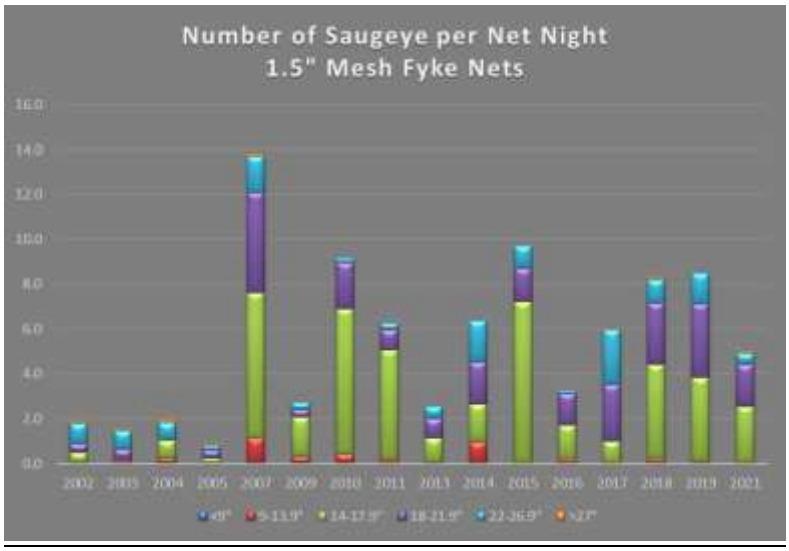
Saugeye were first stocked into the lake in 1992 as part of a study for the North Central Division of the American Fisheries Society. The study was planned for five years, making 1996 the last year. Saugeye have been stocked every year since 1992 and has resulted in a very good fishery. The annual requested stocking is 37,040 (40 per acre).

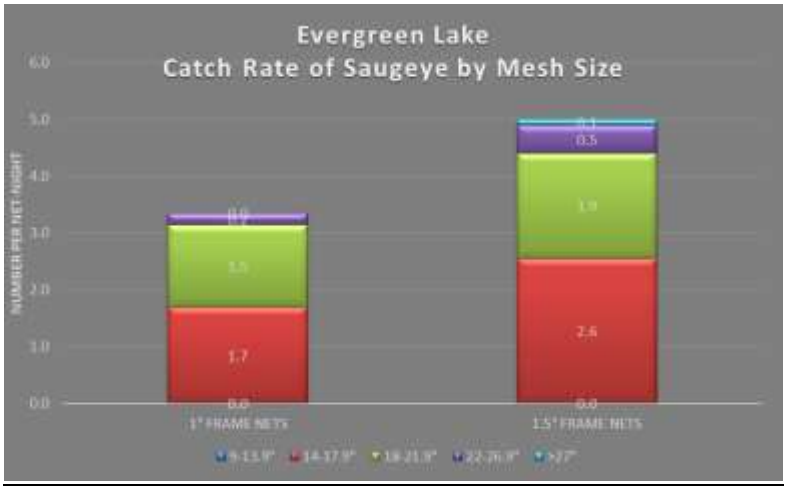
No Saugeye were stocked in 2020 and 65,038 fingerling Saugeye were stocked in 2021. An additional 792,000 fry were stocked in 2021.



Density

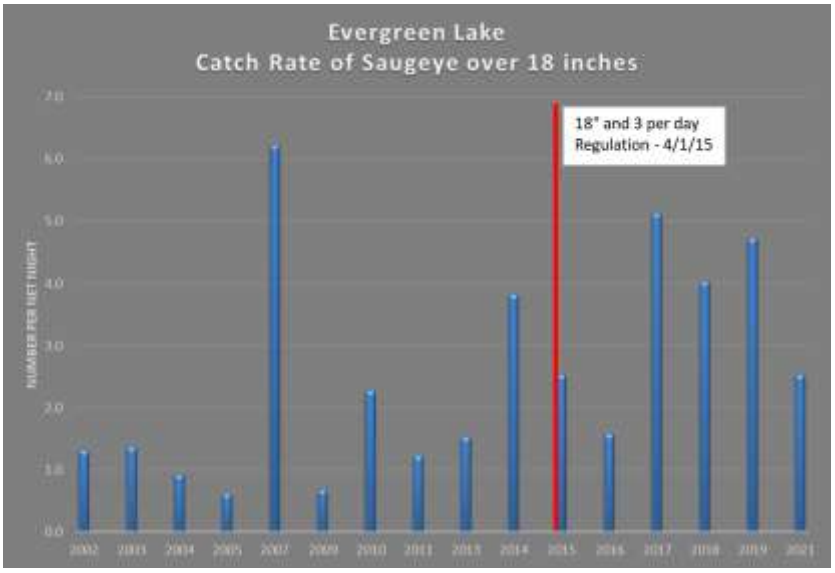
Since the nets have 1.5" mesh, the nets fail to collect smaller saugeye, but the nets catch a larger number of big Saugeye than fall nighttime electrofishing. Netting surveys have been a poor indication of young year classes for Saugeye but were a good indication of legal-sized fish. No Saugeye have been collected less than 9 inches during the spring netting surveys. In 2015, the catch rate was 9.7 per net-night and declined to 3.3 per net night in 2016. In 2015, the regulation was changed from a 14" minimum length limit and 6 per day harvest limit to an 18" minimum length limit and a 3 per day harvest limit. In 2018, the catch rate increased to 8.3 per net-night and the catch rate changed very little in 2019. In 2021, the catch rate for both net types combined was 4.2 per net-night. Approximately 85% of the Saugeye collected in 2021 came from 3 nets, net 1 (56), net 2 (46), and net 20 (41). The walleye management plan has a catch rate objective of 2.5 walleye per net-night. There currently is not a Saugeye management plan for Illinois.





Size Structure

Of all the Saugeye collected over 9 inches in 2021, 100% were longer than 14 inches and 49% were longer than 18 inches. In 2017, the catch rate for Saugeye over 18 inches was 5.1 per net-night and was the second highest catch rate over the past 15 surveys. In 2019, the catch rate for Saugeye over 18 inches was 4.7 per net-night and was the third highest catch rate over the past 15 surveys. Three of the of the top four catch rates for Saugeye over 18 inches have occurred since the regulation change. In 2021, the catch rate for legal Saugeye declined to 2.5 per net-night.



Condition

Condition, based from relative weight values, was adequate for all sizes and the average relative weight was 97.

SPECIES: SAUGEYE
LAKE: EVERGREEN LAKE
COUNTY: MCLEAN
ACRES: 925
GEAR: 1" FRAME NETS

YEAR	TOTAL NUMBER AND CPE			<S <230 <9"	S-Q 230-349 9-13.9"	Q-P 350-459 14-17.9"	P-M 460-559 18-21.9"	M-T 560-690 22-26.9"	>T >690 >27"	Relative Weight: Average Relative Weight	Relative Weight: S-Q 230-349 9-13.9"	Relative Weight: Q-P 350-459 14-17.9"	Relative Weight: P-M 460-559 18-21.9"	Relative Weight: M-T 560-690 22-26.9"	PSD	RSD-P	RSD-M	EFFORT
2021	NO.=	67		0	0	34	29	4	0									
	CPE=	3.4		0.0	0.0	1.7	1.5	0.2	0.0	98		95	100	112	100	49	6	20
	%			0	0	51	43	6	0									

Rick Bushman, Illinois DNR, LaSalle hatchery

Sauger

Broodfish and Egg Collection

Collection of adult sauger broodfish was carried out at two tournaments held on the Illinois River. The Battle on the River (BOR) tournament was on Sunday, March 14 and the Masters Walleye Circuit (MWC) tournament was on March 19-20. Both tournaments were held at the Spring Valley Boat Club. A total of 43 teams participated in the BOR tournament and the water temperature was 49 °F. The river level was normal. The tournament officials provided two Rubbermaid tanks to hold the anglers fish baskets prior to weigh in.

A total of 194 fish were caught by the anglers. At the weigh-in, sauger were separated by sex and the fish were transported to the hatchery in a 1 ton hauling truck. A total of 79 females and 83 males were taken to the hatchery. Another 1 ton hauling truck was used to transport the remaining 29 sauger and 3 walleye to a release site on the Illinois River.

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 were injected with approximately 250 IU/lb HCG (0.4-0.5 ml/fish) on March 15. Sauger semen was extended according to Moore (1996) on four occasions from March 19-26. 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 were placed in tanks with well water chilled to 53 ºF. On Thursday, March 18 (4 days after collection), the female sauger were checked for spawning. None of the females spawned on March 18 and 72 females were injected with 500 IU/lb HCG and placed in tanks with 58 ºF water, 5 females were returned to the Illinois River.

A total of 91 teams participated in the MWC tournament. A total of 757 fish were caught during the two day tournament. A total of 177 female sauger and 58 male sauger were transported to the fish hatchery. The male sauger were injected with 250 IU/lb HCG (0.4-0.5 ml/fish) on March 19 as they were placed in the hauling tank. The female sauger were transported to the hatchery and placed in tanks with well water at 58 °F. The remaining 477 sauger and 45 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 22, female sauger that did not spawn were injected with 500 IU/lb HCG. The female sauger from the BOR were also checked at the same time, a total of 31 female sauger spawned on March 22. The female sauger from the BOR were checked for spawning daily from March 22-March 25. Fish that had not spawned by March 25 were returned to the Illinois River. The female sauger collected at the MWC were checked for spawning daily from March 25-March 30. The post spawn females were returned to the Illinois River on the same day they were spawned.

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 16.8 million eggs were taken from 221 females collected at both tournaments and 11.0 million fry hatched, resulting in a 65.4% hatch rate. The average weight of the female sauger was 2.0 lb (1.4-3.3 lb). A total of 386.0ml of HCG was injected into male (147.8 ml) and female (238.2 ml) sauger. It took 7 to 9 d for the eggs to hatch (189-243 T.U.) at water temperatures of 58-60 °F. A total of 9.2 million fry were stocked into the Illinois River (Table 4), and three LaSalle Hatchery ponds (1.8 million).

Fingerling Production

Three 2.5 acre LaSalle Hatchery ponds (2-4) were stocked with 2-6 day old fry on April 6-8. The total number of fry stocked was 600,000/pond, which was an average of 240,000/acre. The ponds were finished filling to approximately 1/3 full 3 days prior to the initial 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 1,309,246 fingerlings were produced for stocking in state waters, including 691,789 in the Illinois River, 338,346 in Carlyle Lake, and 53,098 in the DesPlaines River.

The fingerlings were cultured for an average of 53 d (43-76 d), averaged 1.5 inches (1.2-2.0 inches) and weighed 1,397 fish/lb (560-2,091 fish/lb) at harvest. A total of 974.0 lb of sauger fingerlings were produced (129.9 lb/acre). Fish production was above normal, averaging 174,566/acre. Survival averaged 72.7% in the ponds. This was the highest number of sauger fingerlings produced at the LaSalle Fish Hatchery.

Pond water temperatures were moderate (60 °F) at stocking (April 7). Pond temperatures were moderate post stocking until April 20-22 when a cold front dropped the water temperature to 47 °F. Pond temperatures were favorable in early May (60°F) and increased to (70 °F) mid May.

Zooplankton populations were slow to develop and were comprised mainly copepods and rotifers throughout April. The zooplankton population was very week in pond 2 throughout the spring. The zooplankton population in pond 3 began declining the third week of May. Results from test seine sampling on May 17 revealed fish averaging 1.2 inches and harvest began May 20.

Tribune and Cutrine Plus were used to control filamentous algae (Spirogyra and Pithophora). Treatments of a 50:50 mixture Cutrine Plus liquid and Tribune was applied to the ponds once per week at 0.75-1.0 gal/acre depending on the severity of the algae growth. Treatments began May 10 and were applied each week, or as needed, through the first week of June. The total amount of chemical used in each application was diluted with 25-50 gallons of water and applied using a HYPRO power sprayer. Chara was controlled in late May-early June in two of the ponds with granular Cutrine Plus applied at a rate of 12-16 lb/acre.

Walleye

Broodfish and Egg Collection

Broodfish were collected from the Fox Chain O 'Lakes (FCOL) and Kankakee River. 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. A total of 70 male walleye from the FCOL were injected with HCG (250 IU/lb) on April 1 and 30 males were collected on April 6, these fish were not injected with HCG. A total of 30 male walleye from the Kankakee River received a 250 IU/lb injection of HCG.

Broodfish collection on the Kankakee River was performed by Region 2 Streams personnel and was carried out from March 25-26. A total of 22 females were collected from the Kankakee River and 17 spawned from March 27-March 30. The average weight of the females was 4.1 lb (2.2-7.7 lb).

A total of 1.67 million eggs were collected and incubated in five separate batches. The overall hatch rate was 51.0%. Egg volume averaged 111,000/L with an average of 98,588 eggs collected per fish. The eggs were fertilized with fresh semen, water hardened, and treated with iodine identical to the sauger eggs. The eggs hatched in 8 d (216 T.U.) at a water temperature of 59 °F.

Region 2 personnel electrofished the FCOL April 1 and April 5. Broodfish were held at the Spring Grove Hatchery Park overnight and picked the next day. A total of 51 walleye females were transported to the hatchery on April 2 and 34 on April 6. Seven of the females spawned upon arrival at the hatchery, one was spent and the remaining females received a 500 IU/lb injection of HCG. The females averaged 5.4 lb (2.2-10.0 lb).

The fish were spawned using the dry method. The eggs were fertilized 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 9.1 million eggs were collected from 62 FCOL walleye females from April 1-April 9. Egg volume was 117,000/L with an average of 147,096 eggs/fish. The eggs hatched in 8-9 d (216-243 T.U.) at a water temperature of 59 °F. A total of 6.1 million eggs eyed up and hatched (67.4% hatch rate).

A total of 2.2 million fry were stocked in six LaSalle hatchery ponds, 450,000 fry were transferred to the Jake Wolf Fish Hatchery (JWFH) ponds, and 650,000 fry were stocked in the Fin N Feather rearing pond. Fry were also provided to Southern Illinois University and stocked in the Fox Chain O'Lakes.

Fingerling Production

The 2-5 d old FCOL fry (2.2 million) were stocked into a total of six LaSalle Hatchery ponds (1,7-9,11,12). The ponds were stocked April 15-16 and April 23 with a total of 300,000-550,000 fry/pond (150,000-220,000 fry/acre). Pond 6 was stocked with a total of 400,000 fry (2-4 day old) on April 9, and an additional 150,000 fry (5-7 day old) were stocked in the same pond on April 13, for an overall stocking rate of 220,000/acre. The water temperature was 55 °F at stocking. The ponds were finished filling to 1/3 full an average of 7 d (3-10 d) 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 1,453,107 fingerlings were produced for stocking various lakes and rivers in Illinois including 364,745 in the FCOL, 217,068 in Clinton Lake, 129,220 in the Kankakee River and 128,663 in the Rock River. The fish were cultured for an average of 47 d (39-61 d), the average length was 1.6 inches (1.2-2.0 in) at harvest. The fish weighed an average of 1,138 fish/lb (558-2,097 fish/lb). Overall survival averaged 44.7%, with a range from 31.0-55.1% (Table 9). Fish production was above normal, averaging 88,067/acre. A total of 1,267 lb of walleye fingerlings were harvested (78.1 lb/acre).

Fry were stocked when the water temperature was 57°F. Pond temperatures decreased April 20-22 when a cold front dropped the water temperature to 47 °F. Pond remained cool (60 °F) through the first three weeks of May and rose to above 70 °F in late May.

Moderate numbers of zooplankton, consisting of 50%-75% copepods and rotifers were present by the third week of April. By late April zooplankton populations began shifting to more daphnia and copepods with total number of organisms increasing. By the third week of May zooplankton numbers began decreasing and few zooplankton were found in ponds 7-8. Results from test seine samples on May 14 revealed fingerlings averaging 1.0 inches, with fish harvest beginning May 19.

Treatments of a 50:50 mixture Cutrine Plus liquid and Tribune was applied to the ponds once/week at 0.75-1.25 gal/acre to control filamentous algae (Spirogyra and Pithophora). Treatments were carried out in early May through the

first week of June on an as needed basis. The total amount of chemical used in each application was diluted with 25-50 gal of water and applied using a HYPRO power sprayer. Chara was controlled in late May-early June in three of the ponds with granular Cutrine Plus applied at a rate of 12-16 lb/acre.

Walleye x Sauger Hybrids

Eggs from 16 female walleye from the FCOL were used for the production of saugeye in 2021. All the fish were injected with HCG at 500 IU/lb to initiate ovulation. A total of 2.1 million eggs were collected on April 4 and April 9. A total of 1.3 million eggs eyed up and the overall hatch rate was 59.9%. The eggs were fertilized with extended sauger semen, water hardened and treated with iodine identical to the sauger eggs. The eggs hatched in 8-9 d (216-243 T.U.) at a water temperature of 59 °F.

A total of 550,000 fry (2-5 day old) were stocked in two hatchery ponds (13,16) on April 15-16. The overall stocking rate was 141,000/acre. Surplus fry (792,000) were stocked in Lake Evergreen (Table 10). The ponds were finished filling to 1/3 full 4 d prior to the initial 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 328,227 fingerlings were raised for stocking in lakes. The fingerlings were cultured for an average of 44 d (34-62 d). Average length at harvest was 1.6 inches (1.3-2.4) and average weight was 928 fish/lb (280-1,697 fish/lb). Fish production was above normal, averaging 93,718/acre. A total of 391.9 lb of fingerlings were produced (114.5 lb/acre) (Table 12). Overall survival was 65.6%. Zooplankton populations were dominated by copepods (50%) in moderate abundance by the third week of April. By the first week of May zooplankton populations were comprised of 90% copepods. The total number of copepods remained high through the third week of May. Test seine sampling on May 17 revealed the fish present were 1.2-1.3 inches in length and harvest began May 19. Vegetation was controlled in the same manner as with the walleye and sauger ponds.

Iowa 2022 Winter Walleye Technical Committee Report submitted by Andy Jansen

1) Fish Culture Update

Contact: Chris Clouse—Hatchery Biologist, chris.clouse@dnr.iowa.gov

- *OTC marking project:* This was the second year of Research Project 7061 which looks to study the difference between Lake and River Strain Walleye stockings. Walleye fry for the project were marked using Terramycin 343 at a dosage of 700 ppm. Fry were hatched on the Quiescent Zone Incubators set up on T35, T36, T39, and T40. The eggs for these incubators were transferred from other hatchery incubators once they had reached the eyed stage. River Strain and Lake Strain eggs were carefully separated so there was no cross contamination between strains. All OTC marked fry requests were met except Saylorville Lake, due to complications related to the age of fry required for proper oxytetracycline marking. OTC-marked fry were stocked into Saylorville Lake, Rock Creek Lake, Lake Belva Deer, and Lake Sugema in May 2021. A sample of OTC-marked fish of each strain were held back for one month to verify OTC detection, and initial examination of known marks revealed visible marks on both strains. Nighttime electrofishing was conducted at all study reservoirs to gauge stocking success, and catch rates of Age-0 fish were poor in general, with no particular study lake yielding high catch rates. Stocking in 2021 appears to have had low success, but similar outcomes have been reported by fisheries managers in non-study lakes as well. Stocking for this study will continue at all locations in 2022. Notably, Gizzard Shad were detected in Lake Sugema since this study began, and the decision has been made to retain the reservoir in the study.
- *Delayed Fertilization Technique Eggs vs. Water Hardened Eggs:* One of the most noteworthy findings this year was the 33.6% difference in hatch rate between water hardened eggs from Storm Lake compared to DFT egg methods. This data was gathered from hatch rates of 176 quarts of eggs water hardened in de-chlorinated water and 185.75 quarts of eggs spawned using the DFT method. If all the eggs from Storm Lake would have been water hardened it is estimated we would have had an additional 10.4M fry. Water hardening all of the eggs from Storm Lake should be the standard procedure in the upcoming years since significant data collection demonstrated that water hardened eggs perform better at the hatchery.
- *Captive Broodstock Project:* An important improvement that should be completed before next season is the use of PIT tag information to differentiate River and Lake Strain Captive Broodfish. Due to lack of PIT tag information RS female brood fish were inaccurately paired with LS males. This mistake resulted in production of 1.4M fry that had no obvious use and were eventually stocked into the Upper Mississippi River. Finally, the capture of Broodfish from the Mississippi River made a significant contribution to the River Strain Walleye fry available for stocking. The effects of electrofishing, netting, transport, injection, handling, and spawning caused significant stress and mortality. A better approach to procuring these eggs should be investigated. Possibilities include receiving eggs that are water hardened, DFT, or shifting River Strain fry production. Please see captive broodstock summary table below.

Source	Brought In	Spawned Without Injection	Injected With hCG	Spawned After Injection	Not Spawned	Quarts/ Female
Female Captive Broodstock (LS) [a]	285	0	285	272	13	0.72
Female Captive Broodstock (RS) [b]	32	0	32	31	1	0.69
Male Captive Broodstock (RS) [b]	75		15			
Total	317	114	317	303	14	

[a] (LS) = lake strain

[b](RS) = river strain

Contact: Andy Fowler--Hatchery Biologist, andy.fowler@dnr.iowa.gov

WALLEYE FRY PRODUCTION

Production Techniques

We again joined with Cordova Power Plant personnel to gather and spawn walleye in 2021. In late March and early April we assisted Cordova with collection of broodstock from Iowa boat ramps taking all safety precautions. Broodstock were collected via day and night electrofishing (March 22, April 1 and April 5) and trammel netting on March 25. Fairport staff conducted electrofishing and trammel netting on Pools 13 and 16 while Cordova electrofished only from Pool 14 near Clinton. Broodstock were brought directly to the Cordova Hatchery. Time was also spent collecting adult walleyes for Rathbun hatchery's riverstrain walleye program due to mortality in captive broodstock at their hatchery. A total of 80 females and 40 males were collected for Rathbun. Fish for this effort originated both from Pool 14 and Pool 13 electrofishing efforts. Pool 14 fish were collected by Cordova and Fairport staff. Pool 13 fish were collected by Bellevue Fisheries Research Staff.

Cordova handled all of the injection, semen collection, and semen extension with some help from Fairport staff. Females were injected twice with Chorulon, an approved human chorionic gonadotropin hormone (hCG) preparation for finfish species at a dosage of 500 IU/kg body weight spaced 2 days apart. Males were stripped and extended. Fairport personnel traveled to Cordova to assist in spawning activities and returned fertilized eggs to the hatchery.

Production Results

On April 6 and 8, a total of 39 qts of walleye eggs and 4.5 qts of saugeye eggs were brought back to Fairport and placed into jars in the hatching unit. Several jars exhibited excessive adhesiveness starting on April 10 and 12th and were run through a screen to break up clumps. Eggs were treated as needed with hydrogen peroxide to kill fungus. Dead eggs were removed by the suction method once they separated out in jars. The saugeye eggs did not have good viability and one jar was discarded. Eggs began hatching on April 16th. Rathbun completed some trials in 2019 using darkened raceways with baffles and a light source to help settle out egg shells, keep screens clean, and sort out live fry. A similar setup was tried at Fairport this year and was very successful. Fry were measured using displacement after this sorting process consolidated them. They were then moved to raceways to mature another day and moved out to the ponds as they became available.

WALLEYE FINGERLING PRODUCTION

Production Techniques

Eleven ponds totaling 8.62 surface acres were used to raise walleye in 2021. Pond 35 was started the earliest, on March 31, for use as a settling basin/water supply to the hatching building. Pond 36 was started on April 12 with a filter sock that was later removed because the pond was not filling fast enough. Ponds 27, 28, 37, 38, and 41-43 were started on April 13. Pond 40 was started later than others on April 16; it was an overwintered pond containing excessive algae and it was left to dry longer in the spring after overwintered fish were removed. Pond 28c was started on April 19 after the cast iron drain valve was repaired. As fry became available from the hatching unit, they were stocked into ponds from April 15-21. All ponds were stocked at a rate of 125,000 per acre.

Dissolved oxygen, nitrate, ammonia, and pH were measured daily. One hundred pounds per acre of alfalfa meal was added to the ponds as they filled. At 1-week intervals, up to 100 lbs/acre of alfalfa meal was added to all ponds as long as dissolved oxygen levels were above 3 ppm on the bottom. Soybean meal was added at 25 lbs/acre weekly. Soybean meal was not added if unionized ammonia was above 0.05 mg/L. Both fertilizers were omitted if unionized ammonia was exceptionally high.

Filamentous algae and rooted vegetation were treated with herbicides. If needed, predatory aquatic insects were treated with six gallons of vegetable oil per acre. This treatment was not used until at least five days post stocking so as not to interfere with gas bladder inflation.

Water was added into the ponds if dissolved oxygen levels dropped below 2 ppm on the bottom. Fish were sampled in each pond on May 20 to determine growth and survival. Due to lack of seasonal personnel, plankton samples were not taken weekly to monitor food availability. The ponds were drained at 33-44 days.

Production Results and Costs

Walleye production varied greatly between ponds. Average return was 38.5% with a range of 19.27% to 60.24%. Ponds 41-43 were difficult to keep full and constantly had water running to them which may have affected growth and returns (Table 2).

Table 2. Walleye production and cost at Fairport Fish Hatchery, 2021

Walleye fry stocked	1,081,300
Number returned	660,215
Percent return	38.5
Total pounds produced	593.9
Average #/lb.	1112
Total production cost	$19,495.86
Cost per 1,000 fingerlings	$29.53

2) Iowa State University Fisheries Research Update

Contact: Maddie Lewis and Dr. Michael Weber, mjw@iastate.edu

- Phase two of the Big Creek and Brushy Creek escapement project began in 2021, and two new graduate students were hired (Madeline Lewis, PhD student, Thomas Miles, MS student). Prior to the barrier installation at Brushy Creek, Walleye escapement was estimated at 22-47% annually from 2016-2019. To continue monitoring escapement from both lakes post-barrier installation at Brushy Creek (summer 2020), 1,000 Walleye were PIT-tagged and stocked into Big Creek and 1,000 Walleye were PIT-tagged and stocked into Brushy Creek in fall 2021. IDNR night electrofishing occurred in early November 2021 and lasted one night at each lake. At Big Creek, 189 Walleye were collected and at Brushy Creek, 35 Walleye were collected. Thirty-five acoustic telemetry tags were purchased per lake to further evaluate movement and behavior of Walleye and nine acoustic telemetry receivers were set on Big Creek and 10 receivers were set on Brushy Creek. On Big Creek, we

tagged a total of 30 Walleye, 15 with V13 tags, and 15 with V16TP sensor tags which indicate depth and temperature of the fish. On Brushy Creek, we tagged four Walleye with V13 tags and three Walleye with V16 tags. Acoustic tagged Walleye also received two external reward tags (jaw tag and internal anchor FLOY tag) to encourage angler reporting and tag return. One Walleye with an acoustic tag was captured in November 2021 and the tag was returned for redeployment. The remaining telemetry tags will be deployed in spring 2022 and we will continue sampling through 2024.

3) Natural Lakes Fisheries Research Update

Contact: Jonathan Meerbeek, Fisheries Research Biologist, jonathan.meerbeek@dnr.iowa.gov

- Protected slot limit and minimum length limit changes in Iowa's broodstock natural lakes: changed from a 17-22 in protected slot (daily bag of 3; 1 fish over 22) in Storm Lake, Spirit Lake, East Okoboji Lake, and West Okoboji Lake to a 19-25 in protected slot (daily bag of 3; 1 fish over 25). At Clear Lake, changed from a minimum length limit of 14 in to a protected slot limit of 17-22 in (daily bag of 3; 1 fish over 22). Full report of study leading to length limit changes can be found at: https://www.researchgate.net/publication/353956217_Evaluation_of_a_protected_slot_limit_and_a_14-inch_minimum_length_limit_for_Walleye_in_Iowa's_broodstock_natural_lakes
- Continue to collect data (gillnetting, electrofishing) to monitor Walleye population dynamics.

4) Rivers and Streams Fisheries Research Update

Contact: Greg Gelwicks, Fisheries Research Biologist, gregory.gelwicks@dnr.iowa.gov

Walleye fingerling stocking has greatly increased Iowa's interior river Walleye populations over the last 20 years. This has resulted in an increasingly popular fishery that has brought Walleye fishing opportunities close to home for many Iowa anglers. The success of this program has also increased demand for two inch long, Mississippi River strain Walleye fingerlings. Limited hatchery capacity has made it difficult to consistently produce enough fingerlings of the size and genetic strain requested for the program. Providing information needed to more efficiently utilize our limited hatchery production capacity and exploring the potential of alternative fish culture systems in meeting the demands of the river Walleye program is the focus of this study.

Available pond culture space has been a limiting factor for producing Mississippi River strain fingerling Walleye to stock in interior rivers. Recent research at the Rathbun Fish Culture Research Facility has shown promising results raising Walleye fingerlings using an alternative method, intensive fry culture. Intensively reared Walleye fry are stocked into flow-through tanks and trained on formulated feed from day 1 post-hatch, instead of stocking them into ponds where they feed on zooplankton (extensively reared). Evaluating the relative contribution of intensively reared fingerlings to interior river Walleye fisheries will determine whether this production method could help further improve river Walleye fisheries.

Study sites were selected on four Iowa rivers to evaluate the relative contribution of intensively reared Walleye fingerlings to interior river Walleye populations. Extensively reared fingerlings were marked, hauled, and stocked in approximately equal numbers alongside of intensively reared fingerlings to serve as a control. Walleye fingerlings produced by this culture method are known to survive and contribute to river Walleye fisheries if river conditions are favorable. Intensively reared Walleye fingerlings were marked with a circle freeze brand and extensively reared fish were marked with a bar brand. Between 44,000 and 57,500 marked intensively and extensively cultured Walleye fingerlings were stocked annually in the Wapsipinicon, Maquoketa, and Cedar rivers during June 2015-2017, and in the Shell Rock River in June 2016. Study sites were sampled in late-September and October each year to determine survival and growth of walleye fingerlings. Sampling results indicate that intensively reared fingerlings contributed to interior river Walleye populations at a significantly lower rate than expected based on stocking ratios of intensively and extensively reared fingerlings during these years. Intensively reared fingerlings have accounted for 20% or less of

branded young-of-year fish sampled during fall at most sites during most years. Production difficulties did not allow comparisons of fingerlings stocked in 2018 and 2019.

Intensively and extensively reared fingerlings were branded for stocking in the Wapsipinicon, Maquoketa, Cedar, and Shell Rock rivers during June 2020. While branding, heavy rains caused our study rivers to become high and muddy and past research indicated that these conditions result in poor survival of stocked fingerlings. One perceived advantage of intensively reared fingerlings is that, unlike extensively reared fingerlings, they can be held and stocked when conditions improve. To test this, extensively reared fingerlings were stocked after branding, and stocking of intensively reared fish was delayed for five days. By this time, river levels had dropped and water clarity had improved. Intensively reared fingerlings were also much larger at stocking (300 fish/pound) than extensive reared fish (800 fish/pound). More age 0 extensively reared than intensive reared fish were sampled at all sites during fall 2020, but these differences were not significant. This indicates that although intensively reared fish were stocked at a larger size into better conditions, their survival was at best similar to extensive fish stocked at a smaller size into worse conditions. Over all sites and years, catch-per-unit-effort (CPUE) of age 0 extensively reared fish averaged 3.7 and ranged from 0.2 to 10.5 fish/hour. CPUE of intensively reared fish averaged only 1.1 and ranged from 0 to 3.5 fish/hour. Collective results indicate that intensively reared walleye fingerlings do not survive as well as expected relative to extensively reared fingerlings in Iowa's rivers. A completion report for this study will be prepared this year.

Michigan 2022 Winter Walleye Technical Committee Report submitted by Ed Roseman

Michigan DNR Fisheries Division released their updated "Management Plan for Walleye in Michigan's Inland Waters" in December 2021. The report was prepared by Seth J. Herbst, Daniel B. Hayes, Kevin Wehrly, Christian LeSage, Dave Clapp, Jennifer Johnson, Patrick Hanchin, Emily Martin, Frank Lupi and Tim Cwalinski. This analysis makes use of habitat suitability indices to score walleye waters, describes various metric used for assessment, discusses co-management strategies with Tribes, and uses decision tree analysis to evaluate management options. The report can be found at: https://www.michigan.gov/documents/dnr/Walleye_Management_Plan_FINAL_745946_7.pdf

Saginaw Bay and adjoining tributaries continue to be hotspots for walleye production. To provide more angling opportunities for bank and small boat fishers, the Michigan DNR Natural Resources Committee recently approved a proposal to open walleye fishing year-round in the Lower Saginaw River from Center Street in Saginaw to the mouth of the river beginning in 2023. The DNR will use ongoing programs to monitor and assist in the management of the new fishery such as creel surveys which provide angler catch rates, effort, and biodata such as walleye size, sex ratio, and age. Supplemental, information on the status and health of the walleye population will be obtained during the Dow Dam spring tagging studies and monitoring work which is conducted during the spawning season. Please contact the Bay City Fisheries Unit Supervisor, Dr. Jeff Jolly, with questions or comments: jolleyj1@michigan.gov.

In collaboration with the U.S. Geological Survey, the University of Toledo, the Ohio Division of Wildlife, and the Michigan Department of Natural Resources, Touhue Yang, a recent MS graduate student from the University of Toledo advised by Dr. Christine Mayer, successfully defended his thesis work comparing contemporary diets of western Lake Erie age-0 walleye (larval and young of year) with historical diets collected by Ed Roseman during the mid 1990's. In the last few decades, Lake Erie has experienced several unintentional introductions of aquatic invasive species (AIS) that have likely led to environmental and food web changes, potentially impacting age-0 walleye diet and growth. Fisheries managers desire an understanding of how diet composition and growth of age-0 walleye have changed in western Lake Erie since 1990's in response to food web changes. Touhue's work found that during the pelagic larval stage, copepods dominated diets of recently hatched walleye in both contemporary and historical diets. During the demersal juvenile stage, his work found that diets of contemporary walleye were made up mostly of zooplankton, benthic invertebrates, and AIS prey, whereas diets of historical walleye were made up almost entirely of native fish prey. Consequently, walleye size at the end of their first growing season were smaller compared to historical walleye. Although walleye were smaller on average than historical walleye, the high proportion of non-empty stomachs and high numbers of demersal juvenile walleye at the end of the first growing season suggests fish were consuming enough prey items to avoid starvation. Touhue's results show that age-0 walleye seem to be adapting to food web changes in western Lake Erie, but continued

examination of age-0 walleye diet would provide confirmation on whether contemporary diets consistently contain less fish prey and more invertebrates and AIS because of food web changes or because of other complicating factors.

Michigan DNR's interactive fish stocking database contains updated records on Walleye stocking: https://www2.dnr.state.mi.us/fishstock/

Recent Walleye Related Publications:

Euclide, P.T., Robinson, J., Faust, M., Ludsin, S.A., MacDougall, T.M., Marschall, E.A., Chen, K.Y., Wilson, C., Bootsma, M., Stott, W. and Scribner, K.T., 2021. Using genomic data to guide walleye management in the Great Lakes. In Yellow Perch, Walleye, and Sauger: Aspects of Ecology, Management, and Culture (pp. 115-139). Springer, Cham.

Fischer, J., E.F. Roseman, C. Mayer, T. Wills, L. Vaccaro, J. Read, B. Manny, G. Kennedy, R. Ellison, R. Drouin, R.L. DeBruyne, A. Cotel, J. Chiotti, J. Boase, and D. Bennion. 2021. A Structured Approach to Remediation Site Assessment: Lessons from 15 Years of Fish Spawning Habitat Creation in the St. Clair-Detroit River System. Restoration Ecology. https://doi.org/10.1111/rec.13359

Gatch, A.J., S.T. Koenigbauer, E.F. Roseman, and T.O. Höök. 2021. Assessment of Two Techniques for Remediation of Lacustrine Rocky Reef Spawning Habitat. North American Journal of Fisheries Management. https://doi.org/10.1002/nafm.10557

Haas, R.C. and Thomas, M.V., 2022. Nutrient levels and plankton populations of five Great Lakes tributaries and their relation to walleye year class strength (spawning success). *Mich. Dept. Nat. Resour. Fish. Div. Res. Rep*.

Kalejs, N.I., M.T. Zischke, J.Beugly, P.D. Collingsworth, E.F. Roseman, R.D. Hunter, D.G. Fielder, and T.O. Höök. In press. An Evaluation of Fish Spawning on Degraded and Remnant Reefs in Saginaw Bay, Lake Huron. Journal of Great Lakes Research. Accepted 1/20/22.

May, C.J., Budnik, R.R., S.A. Ludsin, D.R. O'Donnell, J.M. Hood, E.F. Roseman, and E.A. Marschall. 2021. Evidence that zooplankton quantity and quality during the larval period regulates recruitment of Lake Erie walleye. Journal of Great Lakes Research. https://doi.org/10.1016/j.jglr.2021.09.009

O'Connor, L.M., R. Aikens, A. Bowen, S. Chong, D.G. Fielder, and N. Godby. 2020. Population Dynamics of the St. Marys River Fish Community 1975-2017. St. Marys River Fisheries Task Group, Lake Huron Technical Committee, Lake Huron Committee, Great Lakes Fishery Commission, Ann Arbor, MI.

Pagano, J.J. and Garner, A.J., 2021. Polychlorinated Naphthalenes across the Great Lakes: Lake Trout and Walleye Concentrations, Trends, and TEQ Assessment—2004–2018. Environmental Science & Technology, 55(4), pp.2411-2421.

Roseman, E.F., M. DuFour, J. Pritt, J. Fischer, R.L. DeBruyne, and D. Bennion. 2021. Export of Pelagic Fish Larvae from the Detroit River. Advances in Limnology 566:225-243. https:// DOI: 10.1127/adv_limnol/2021/0060.

Whitinger, J.A., Zorn, T.G. and Gerig, B.S. In press. Stable Isotope Signatures and Displacement Patterns of Walleye Change Following Establishment of Dreissenid Mussels in a Lake Michigan Embayment. North American Journal of Fisheries Management. https://doi.org/10.1002/nafm.10733

Zorn, T.G. and Kramer, D.R., 2021. Changes in Habitat Conditions, Fish Populations, and the Fishery in Northern Green Bay, Lake Michigan, 1989–2019. North American Journal of Fisheries Management. https://doi.org/10.1002/nafm.10715

Minnesota 2022 Winter Walleye Technical Committee Report submitted by Dale Logsdon

2021 Walleye Stocking:

263,827,589 fry
1,083,412 fingerlings
92,604 yearlings or adults

Statewide stocking was increased during 2021 to make up for reduced stocking in 2020 that resulted from Covid caused lack of egg take.

Personnel Changes:

Regional manager Henry Drewes and Research Scientists Mike McInerny and Donna Dustin retired. Wade Massure is new Supervisor for the Park Rapids Fisheries Area, Alexander Letvin is new Supervisor for Glenwood Area and Keith Reeves is new Supervisor for Tower Area. Kristen Patterson and Devon Oliver are new Research Scientists.

General:

Continue to see high fishing pressure, license sales, and equipment sales statewide in 2021. Increasing proportion of effort/harvest occurring during winter and at night. Some angling groups are beginning to express concerns about the increasing number of wheelhouses (large, trailer-type ice fishing shelters) and use of Livescope technology. Bill to reduce statewide bag limit from 6 to 4 failed in legislature last year but will likely be submitted again this year due to strong support by some influential angler groups. Increasing sampling on zebra mussel infested and some reference lakes to help better understand effects of zebra mussels on walleye populations.

Large Lake Summaries:

Lake of the Woods: catch rate was below the 3-y average (14 fish/net), at 11/net this year. Some weaker year classes moving through, 2020 year class looks promising. Sauger population is above-average (26/net is well-above goal). Fishing pressure continues to increase.

Red Lake: continue to see strong gill-net catch rates, are in surplus condition and a more liberal harvest regulation of 4 fish for this winter. Good representation of young fish on Red.

Cass Lake: walleye population meeting or exceeding all population goals. Will stay with the statewide 6 fish limit. Really strong 2018 year class at about 14”. Did first night creel and found quite a bit of harvest happening after dark up to midnight.

Kabetogema Lake: gill-net catch rate above long-term average and are seeing good year classes in recent years.

Rainy Lake: gill-net catch about 5/net, a little below average and similar to last year. Recently in a trend of some weaker year classes. Crappie numbers have boomed in recent years. Zebra mussels have been confirmed in Black Bay this summer, not sure what the impact will be because the main body of Rainy doesn’t have much calcium, which zebra mussels need.

Lake Vermillion: net catches above average in both basins. Captured large numbers of YOY electrofishing and big sizes which increased chances for further recruitment.

Mille Lacs: gill-net catches declined this fall due to natural decline in abundance of the 2013 year class that makes up a bulk of the population. The 2017 year class is the next year class starting to carry the fishery, and a couple average year classes since 2017. The Perch population has increased recently, and that bite has picked

up. Forage also increased recently, and we saw some condition improvements, but still not back to where things were historically.

Lake Winnibigoshish: strong recent year classes, big pulse around 14". Average age-0 catch rate.

Lake Pepin: Three consecutive strong year classes have walleye catch rates at near record highs (10.7/ net in 2021) and should remain strong in the near term on that multiyear base. Sauger have experienced less consistent recruitment than typical for the species in Lake Pepin. Several strong year classes in the past six years including the 2020 year class that has only been sampled once, but is preliminarily the third strongest on record, have numbers near the third quartile for lake Pepin (29.71/net in 2021) with good potential for anglers as those 2020 fish are exploited by the fishery over the next several years.

DNR Research:

Dale Logsdon, Loren Miller, and Steve Shroyer 2021 fry stocking represented the third paired-stocking into eight lakes to evaluate performance of Lower Mississippi strain walleye fry to that of the more easily obtainable Upper Mississippi strain. This year's data continue to indicate higher survival of the Lower Mississippi stain walleyes in southern Minnesota lakes. Cost analysis indicated that although the Upper Mississippi strain fry were substantially cheaper to stock, the increased survival of the Lower Mississippi strain resulted in a lower cost-per-return of stocked Lower Mississippi strain Walleye during fall electrofishing.

Loren Miller – In addition to the LMS strain comparison, genetic studies have continued to assess ancestry in walleye populations with a recent focus on west-central lakes, a region that hadn't been well-represented. Some lakes had unexpectedly high ancestry from our LMS strain rather than the closest local strain, an indication that LMS may have been more widely distributed than we realized. Fine-scale genetic structure is being examined in Big Sandy Lake in association with a MNDNR and Iowa State acoustic telemetry project.

Bemidji State University Research:

Environmental influences on the growth of inland cisco populations in three Sentinel Lakes

Edward Carlson, Casey Schoenebeck, Beth Holbrook, Andrew Hafs

Cisco *Coregonus artedi* are a pelagic cold-water fish that are widely distributed throughout many inland lakes across the northern Midwest. Cisco play an important role in lake ecosystems as they are important forage for large piscivores such as Muskellunge, Northern Pike, Walleye and Lake Trout. Cisco populations have been observed to display a range of differences in recruitment, growth, and mortality based on the system in which they are found. With climate change effects becoming more prevalent in Minnesota, biological, chemical, and physical aspects of lake ecosystems are changing and ultimately influencing inland Cisco populations. To investigate how different environmental cues are affecting the population dynamics of inland Cisco, three lakes were selected within Minnesota's northern lakes and forests and north central hardwoods ecoregions. The three lakes were sampled annually for Cisco using hydroacoustic sonar and vertical gill nets from 2011-2020. Supporting information related to pelagic oxythermal habitat, food availability, and abundance of large predators within each system were collected to understand how different environmental factors were influencing inland Cisco population dynamics. A combination of environmental variables were selected *a priori* based on knowledge of Cisco biology to develop 15 linear regression mixed-effect models. The upper 95th percentile of total length (mm) was used as the response variable for each of the 15 models to account for the variation in Cisco length across the three lakes. The best supported model included Secchi depth, Walleye CPUE and Northern Pike CPUE in combination with lake and year as a random effect (Figure 1). These results suggest that predator abundance in combination with light attenuation could be the possible mechanism for driving the total length of Cisco found within these systems. By understanding the effects of changing environments on cold-water fish populations, these results will provide fisheries managers with knowledge to promote and sustain cold-water systems that support large game species such as Walleye.

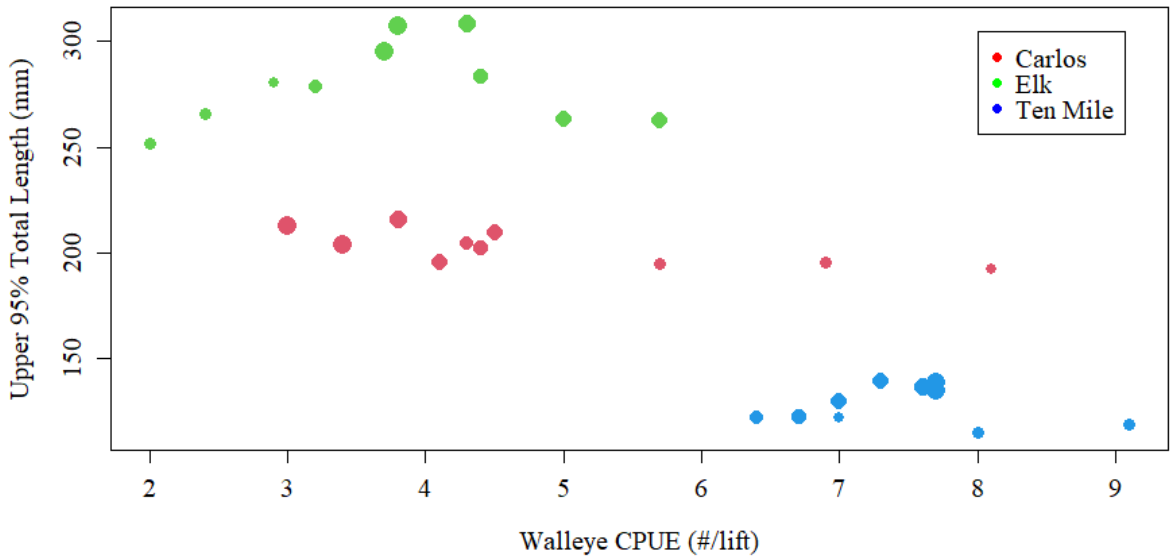


Figure 1- Upper 95% total length of Cisco caught in vertical gillnets as a function of Walleye catch per unit effort for Carlos, Elk, and Ten Mile from 2011-2020.

Updated 4February 2022

Diet Overlap of Piscivores in Minnesota Lakes

Kamden Glade, Brian Herwig, Tyler Ahrenstorff, Jeff Reed, Andrew Hafs

Little is known about the diets of top-tier predatory fishes in Minnesota. Limited research, combined with the high rate of empty stomachs in esocids, lead to a knowledge gap regarding primary diet items and potential niche overlap among piscivores. The goal of this study was to use diet samples from Walleye, Largemouth Bass, Northern Pike, and Muskellunge to quantify the feeding niche of each species. Fish were sampled using a variety of gears including, but not limited to, Fyke nets, large frame trap nets, electrofishing, gill nets, and angling. Diets were collected using gastric lavage or dissection of stomachs and compared among a set of lakes with varying prey fish assemblages to determine potential interspecific competition between species. Ten lakes spread across the northern portion of the state were included in this study. Diet samples will also be used to verify stable isotope samples collected from a larger set of lakes. Diets from 1178 Walleye, 1105 Largemouth Bass, 1043 Northern Pike, and 368 Muskellunge were collected from 2019 to 2021, and analysis is ongoing. Preliminary results indicate that Yellow Perch (YEP) and *Lepomis* spp. (SUN) are significant diet items for Walleye among lake groups, while Black Crappie (BLC), Cyprinids (OTM), invertebrates (INV), and unidentified fish (UNK) served as secondary forage (Figure 1). Additionally, diet overlap among piscivores has been low to moderate (Pianka's Niche Overlap < 0.75, Figure 2) for all species pairs, apart from Northern Pike and Walleye. These two species have an overlap index > 0.75 in lakes that contain both Muskellunge and Cisco, as well as lakes that contain neither Muskellunge nor Cisco. Finally, direct predation on Walleye has been uncommon. Out of more than 3,600 fish diets examined, predation on Walleye has been observed in 3 Muskellunge, 13 Northern Pike, 5 Walleye, and 1 Largemouth Bass.

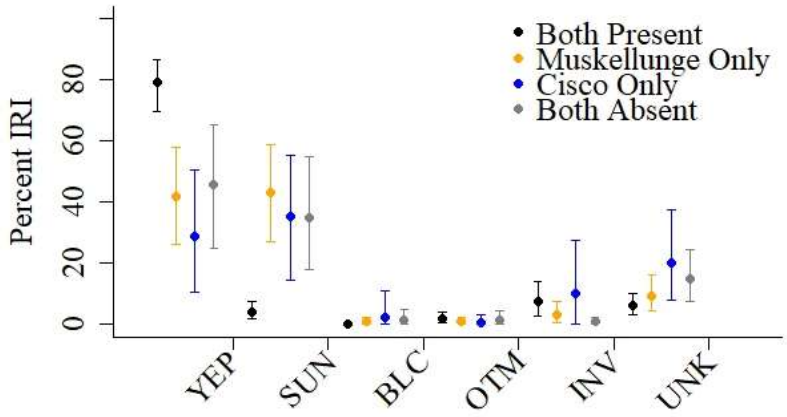


Figure 1. Percent Index of Relative Importance (IRI) for Walleye prey species sampled in lakes with both Muskellunge and Cisco present, Muskellunge Only, Cisco only, or both absent. Points represent observed mean values while error bars represent 95% confidence intervals calculated by bootstrapping the data 1000 times.

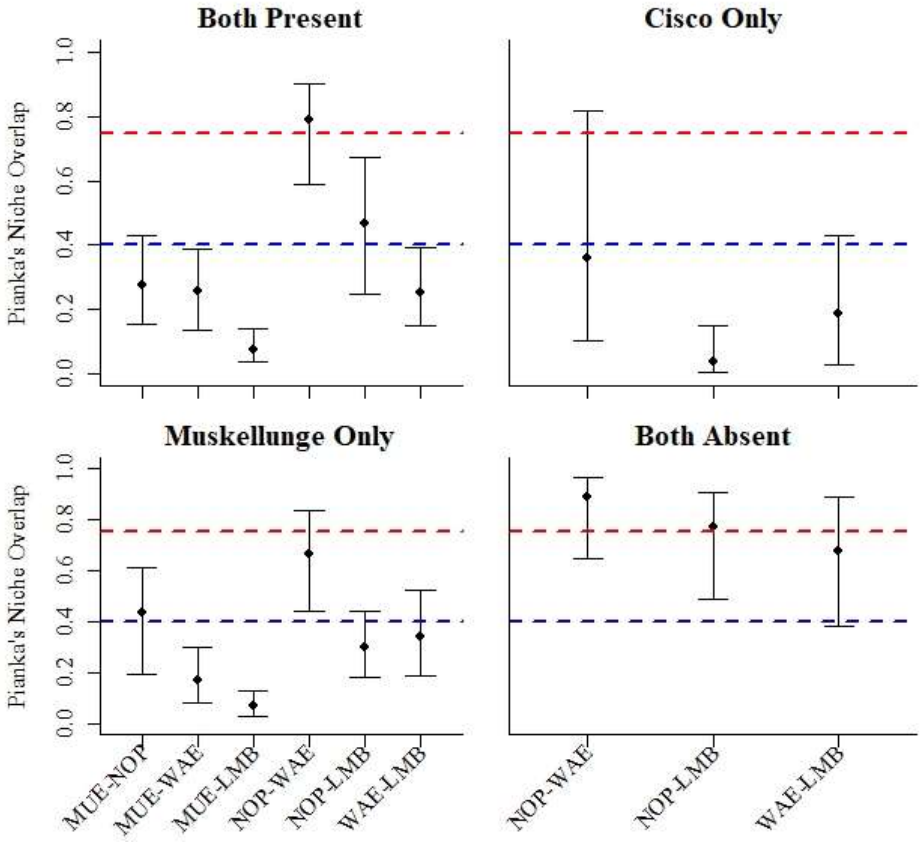


Figure 2. Pianka's index of niche overlap for Muskellunge (MUE), Northern Pike (NOP), Walleye (WAE), and Largemouth Bass (LMB) in lakes with and without Muskellunge and Cisco. Points represent observed mean values and error bars represent 95% confidence intervals calculated by bootstrapping the data 1000 times. Values over 0.75 (red line) indicate high overlap while values below 0.40 (blue line) represent low overlap.

Updated 4 February 2022

Spatial and Temporal Variability of Mercury in Upper and Lower Red Lake Walleye

Tyler Orgon, Andrew Hafs, Carl Isaacson, Shane Bowe, Mark Brigham

Mercury is a global pollutant that is released into our environment by natural and anthropogenic processes resulting in extensive studies of mercury cycling in aquatic ecosystems, and the issuance of human-health-based fish-consumption advisories. We examined total mercury concentrations in Walleye *Sander vitreus* from Upper and Lower Red Lakes, located in north central Minnesota, between 2019 and 2020. Sampled Walleye (n = 265) ranged from 158 to 610 mm in total length from an age range of 0 to 16 years. Mercury concentrations within the Red Lakes ranged from 0.030 mg/kg to 0.564 mg/kg ($\bar{x}$ = 0.179 ± 0.105 mg/kg; $\bar{x}$ = mean ± sd, all fish-mercury concentrations expressed in wet-weight). The best supported model for predicting mercury concentrations in Red Lake Walleye included the independent variables: length, age, sex, and lake basin. This model indicated that basin is an important predictor variable for estimating mercury concentrations between Upper and Lower Red Lake Walleye (Figure 1; $\bar{x}$ = 0.215 ± 0.117 and 0.144 ± 0.077 mg/kg, respectively), and also suggests that individuals who rely on fish for subsistence should target ≤ 400 mm Walleye from Lower Red Lake (Figure 2). The observed differences in mercury concentrations could be linked to wetland area, fish growth rates, and physicochemical parameters between the two basins. After adjusting for length as a covariate, Upper and Lower Red Lake exhibit fish-mercury concentrations comparable to other large lakes within the region. Given that our results illustrated a significant difference in fish-mercury concentrations between basins, future pollutant monitoring efforts should treat Upper and Lower

Red Lake as separate lakes and not assume that data from one basin can apply to the other. This will be important over a longer time scale as ecosystems respond to changes in mercury emissions and other environmental changes.

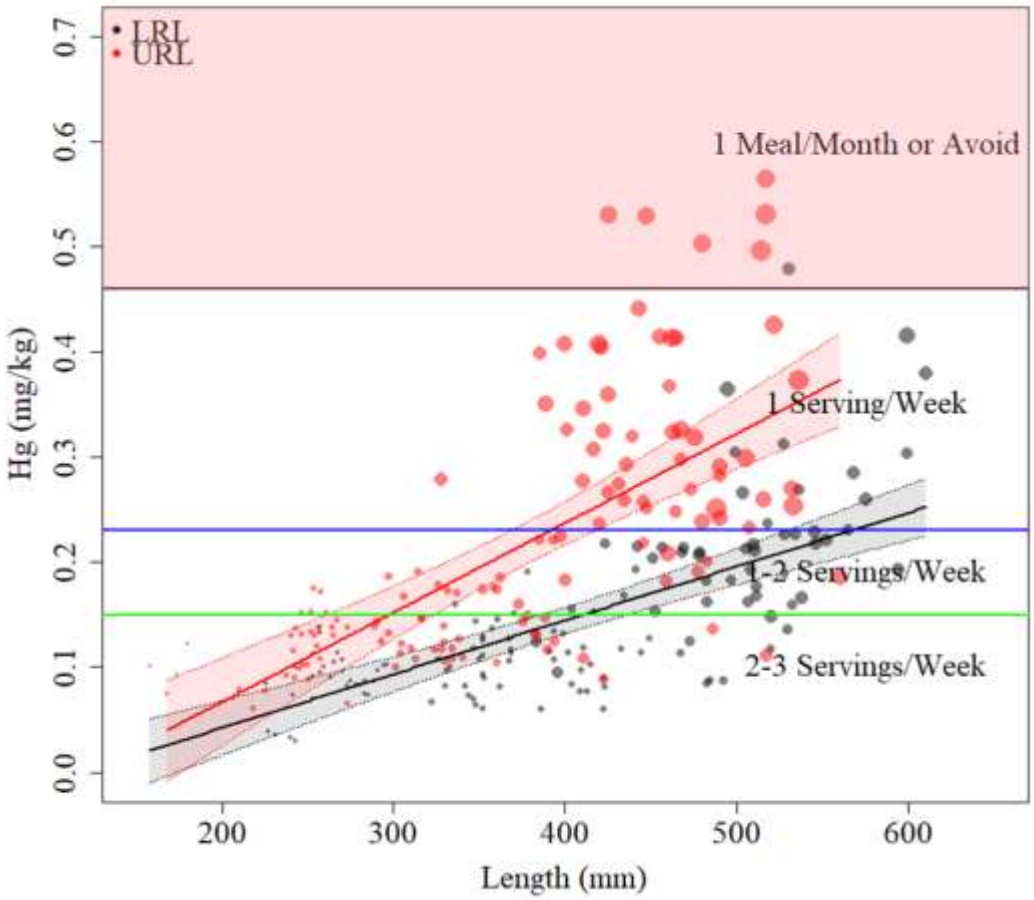


Figure 1: Mercury concentration (by wet weight) from Upper (URL) and Lower (LRL) Red Lake Walleye. Points are weighted based on age on individual Walleye and horizontal colored lines indicate the current fish-based consumption advisory set by the US EPA.

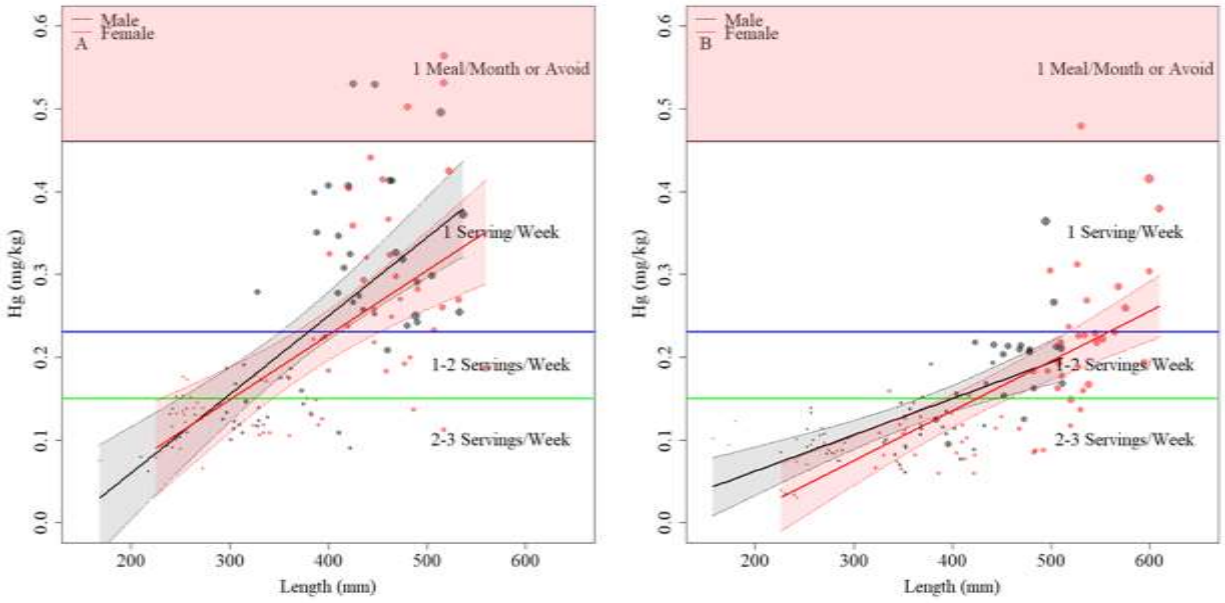


Figure 2: Upper (left) and Lower (right) Red Lake Walleye mercury concentrations (by wet weight) separated by sex (males in black, females in red). The points are individual Walleye that are weighted based on age, and horizontal lines illustrate the fish-based consumption advisory set by the US EPA.

Project completed January 2022

Effects of shallow lake condition shifts on habitat, zooplankton, and Yellow Perch population dynamics

Alicia Skolte, Casey Schoenebeck, Andrew Hafs

Aquatic ecosystems around the world exist on a continuum between turbid, algal-dominated and clear, macrophyte-dominated conditions, which may influence population dynamics of fish in these systems (such as Yellow Perch *Perca flavescens*). Since turbidity influences the amount of light penetration and occurrence of vegetation, spawning and nursery habitat as well as food availability may change depending on lake condition. For example, a decrease in turbidity encourages a shift in the prevalent zooplankton taxa from *Bosmina* spp. to *Daphnia* spp. We hypothesize many factors associated with a condition shift may combine to influence Yellow Perch, including increased abundance and therefore, intraspecific competition resulting in a reduced length and body condition. We used long-term monitoring data from Lake Shaokatan, Minnesota to examine whether a rarely documented condition shift from a turbid, algal-dominated to a clear, macrophyte-dominated condition occurred in 2014 and whether that shift influenced population dynamics of Yellow Perch, including relative abundance (gillnet CPUE), mean total length (mm), and mean relative weight. A condition shift from turbid to clear was determined in 2014 using mixed effects models that showed significant decreases in phosphorous and chlorophyll-a concentration as well as an increase from a mean of 22% to over 90% vegetation occurrence. The zooplankton community qualitatively showed a prevalence of *Daphnia* spp. and Cyclopoids over small cladocerans during the clear condition period until 2018. Mixed effect models were also used to determine the shift to a clear condition resulted in a significant decrease in Yellow Perch mean total length and relative weight. Therefore, the condition shift and resulting habitat changes that occurred in 2014 and later influenced the size and condition of Yellow Perch. Continued monitoring may overcome variability in relative abundance and help elucidate emerging trends.

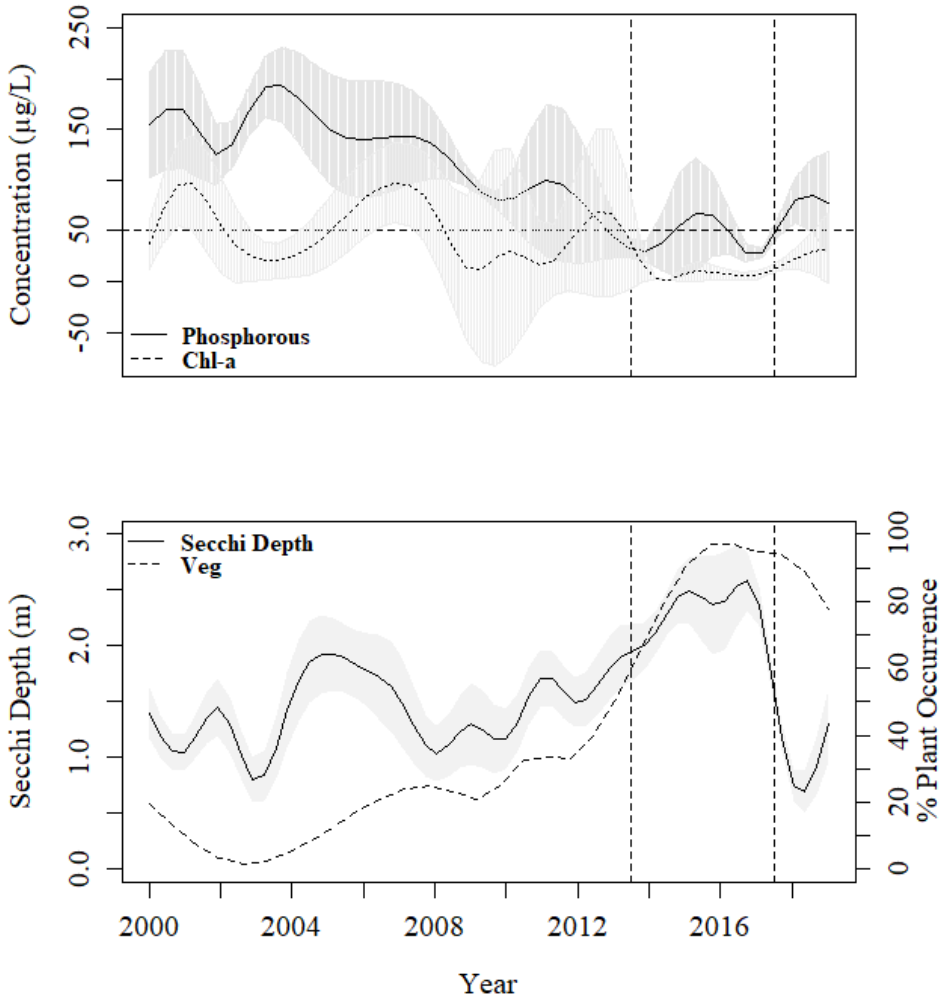


Figure 1. Annual averages of total phosphorous and chlorophyll-a concentration (µ/L) collected April-November, Secchi depth (m) collected May-October, and percent vegetation occurrence in August from 2000 to 2019 in Lake Shaokatan, Lincoln County, MN. Shaded regions represent 95% confidence intervals. Dashed black line prior to 2014 represents condition shift from turbid to clear condition based on thresholds (shown by horizontal dashed line) determined by Vitense et al. (2018). Dotted black line prior to 2018 represents a potential shift to be further monitored.

Project completed December 2021

Assessing the Dispersal and Recruitment of Stocked Walleye Fry in a Northern Minnesota Chain of Lakes

Joseph W. Amundson, Heather Marjamaa, Andrew W. Hafs,

Anthony J. Kennedy, Richard W. Koch

Little is known of the dispersal habits of stocked Walleye fry, especially in a chain of lakes. Assessing the dispersal and quantifying the contribution of stocked Walleye fry is difficult, as conventional fish marking methods are inadequate due to small size of fry at the time of stocking. Chemical marking is a viable alternative, done by fry immersion in an oxytetracycline hydrochloride (OTC) solution. OTC marks are identifiable up to and even beyond four years after immersion using epifluorescent microscopy which results in a golden-yellow fluorescent mark on calcified structures. Using these marking and detection methods, marking rates of age-0 Walleyes were similar throughout the years in each of the study

lakes. Within the Chain, relative abundance of OTC marked fish was highest in Andrusia each year, followed by Wolf, Cass and Kitchi (Figure 1). Pike Bay had one marked fish captured during standard sampling (2016) and Big did not have a marked fish captured (Figure 1)). Marking rates within the Chain where highest in Andrusia each year, followed by Cass, Wolf and Kitchi (Figure 1). Yearly (2016-2018) marking rates within the Chain lakes were consistent, Andrusia (96-99%) having the highest rate each year followed by Cass (80-97%), Wolf (25-39%), and Kitchi (0-24%; Figure 1). Although year class strength varied yearly within the chain, marked fish represented 71 to 79% of fish sampled. The results of this study have shown that fry stocked into Andrusia have the capabilities to disperse throughout the Chain, downstream and upstream, during the first three months of life. Subsequently, OTC marked cohorts (2016 -2018) were captured via gill nets at nearly the same marking rate as they were captured at age-0. Although there seems to be no advantages between marked and unmarked fish in growth or condition in each lake, marked fish made up the majority of each cohort. Growth modeling across distance from stocking site showed total lengths of marked fish increased as total CPUE declined (Figure 2), suggesting some degree of density-dependent growth Chain wide but it is currently unknown if those differences are biologically significant.

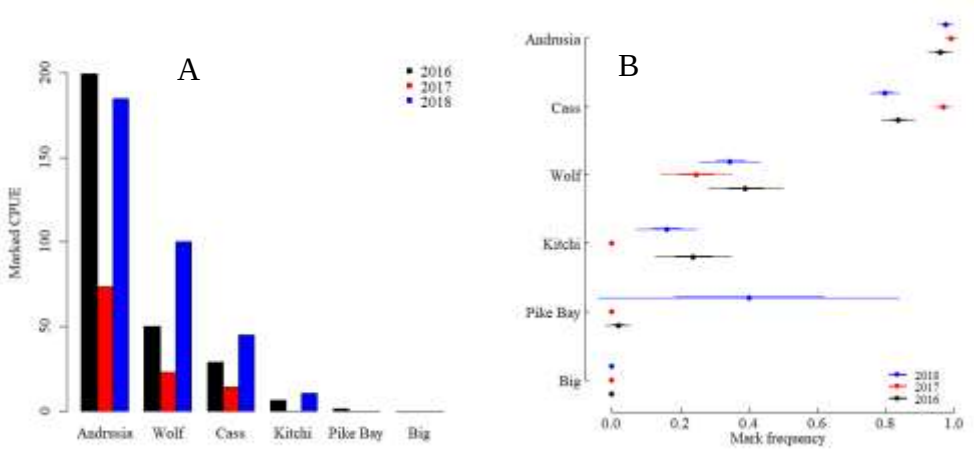


Figure 1. A) Total catch-per-unit-effort (fish/hour) of OTC marked age-0 Walleye of all study lakes, 2016-2018, during late August through early September assessment. B). Age-0 Walleye OTC marking frequency of all fish analyzed for each lake by year. Dot represents marking frequency with lines representing one and two standard errors.

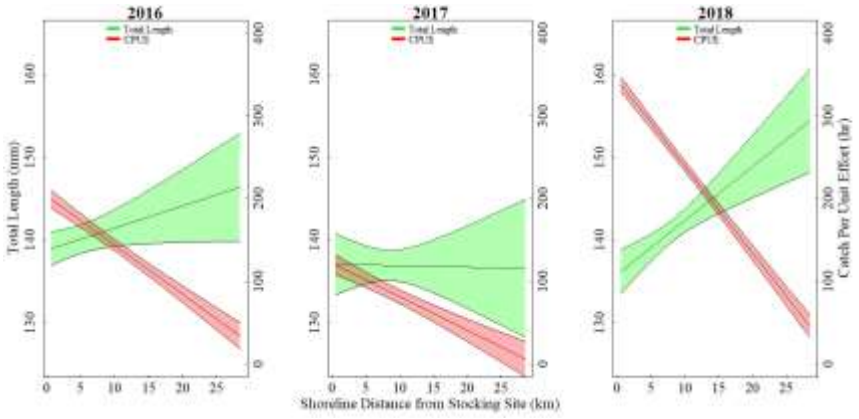


Figure 2. Predicted total length (TL) in millimeters (mm) and predicted total catch-per-unit-effort (CPUE) each year as a product of shoreline distance (km) from stocking site.

Project completed October 2021

Spatial and Temporal Variability in Post-Larval Yellow Perch Density

Steve Hauschildt, Andrew Hafs, Carl Isaacson, Debbie Guelda

Yellow Perch *Perca flavescens* are important as forage for other species and for sport fishing in many northern lakes. However, estimating post-larval Yellow Perch populations can be difficult because of many environmental factors that cause unexplained variation. The objective of this study was to help reduce unexplained variation by determining a post-larval Yellow Perch population density estimate on Blackduck Lake, MN, provide guidance to help determine the number of trawls required for trawling-based recruitment indices to achieve varying levels of precision, and test for the effects of wind speed and direction on post-larval Yellow Perch spatial variability. This study estimated a density of 0.45 fish/m^3 (0.58 SD) during the sampling period (26 Jun – 07 Jul 2017). It was determined that between 10-15 trawls produced a precise density estimate; however, trawls should be taken over multiple days in varying wind speeds to avoid over/under estimation. Trawling should also be performed in-line with wind direction to ensure non-bias estimates are calculated from both upwind and downwind sectors. This study determined wind speed and direction had a significant influence on the distribution of post-larval Yellow Perch, as more fish were caught in the downwind sector until winds reached 15 kmph. At 15 kmph, fish densities were equal in the upwind and downwind sectors of the lake. Wind did not have a significant influence though on how post-larval Yellow Perch were distributed by total length. During high wind events, more fish were found in the upwind sector of the lake, suggesting that post-larval fish are being moved out of non-towable areas. From the results of this study it appears Yellow Perch must continually relocate back into shallow areas after each high wind event moves them out of the non-trawlable areas, until they are strong enough to resist the wind.

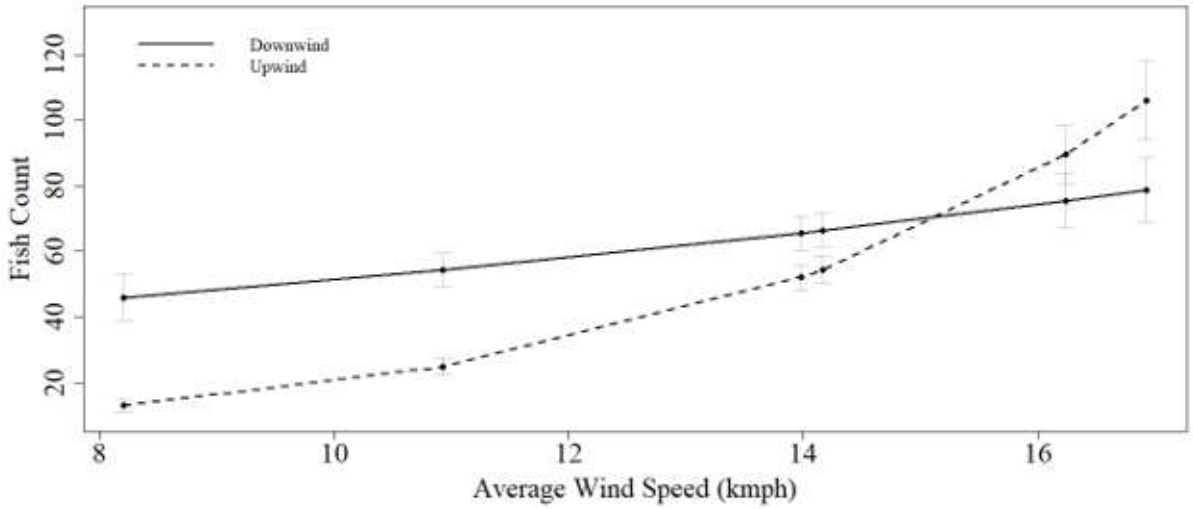


Figure 1. Change in predicted mean fish count in the upwind and downwind sectors of Blackduck Lake, as affected by varying wind speeds (kmph) during the 26 Jun – 07 Jul 17 sampling period. Error bars represent standard error.

Project completed January 2019

University of Minnesota and the University of St. Thomas have also been conducting various research on percids.

Nebraska 2022 Winter Walleye Technical Committee Report submitted by Joe Rydell

Walleye

Walleye spawn activities were a little more normal this past year collecting spawn from Merritt Reservoir. We spawned 379 females and collected just over 600 quarts of eggs in 5 nights of netting. Eye up was good with 72% average.

Our biologists in South East Nebraska have been trying some advanced fingerling walleye stockings the last few years to provide some walleye opportunities for anglers. The goal was to create fisheries with gillnet catches of 5 to 10 walleye per net in the fall. Evaluation of these stockings suggests that 96% of the total walleye gillnet catch from 2015 to 2019 are a result of the advanced fingerling stockings. In fact, the management goal of 5 to 10 fish per net was met in 58% of the time with catch rates ranging from .25 fish per net up to 24.5 fish per net. Reservoirs with established Gizzard Shad or White perch populations had significantly lower catch rates compared to "clean" lanes which were primarily composed of Largemouth bass, bluegill, crappie, and channel catfish.

More walleye research will continue this year on Lake Mac with a creel that will include the night fishing on the Dam from April through May as well as the standard day creel from April to October. The additional creel and research were spurred from a group of unhappy anglers with the current walleye population in Lake McConaughy. University Nebraska Kearney is still evaluating stock contribution of stocked walleye and will be looking at both fingerling and fry stockings in the coming year. In 2021 stock contribution was 90% in Lake Mac. Additionally, research continue to look at spatial distribution of predators, zooplankton and appropriate water quality conditions for stocked fingerlings at Big Mac. These were repeated from previous efforts but the water levels in 2021 were much lower and timing was in June. The intent was to determine the consistency for some of the factors guiding our stocking locations.

A walleye marking study conducted between the North Platte Hatchery, UNK and field biologists evaluated marking techniques in young-of-the-year walleye. Some of the marking techniques include a stress mark, and double marked fry with OTC. The double OTC mark did not look any different (for the most part) than single OTC marks and the stress mark was less than 10% detectable.

NE district biologists assisted South Dakota Game, Fish, and Parks with a telemetry study looking at sauger and walleye movement within Lewis and Clark Reservoir. This study will not only detect movement within the reservoir but also document entrainment through the dam. Another part of the project on Lewis and Clark is evaluating entrainment of young-of-the-year walleye through the dam at Gavins Point.

Yellow Perch

New reservoir construction in Eastern Nebraska allowed opportunity to provide unique stocking options to diversify the fishing opportunities in Urban lakes. Big Elk Lake and Portal Lake were stocked with a smallmouth bass and yellow perch combination and a new daily bag limit of 5 yellow perch will be in place on these fisheries.

North Dakota 2022 Winter Walleye Technical Committee Report submitted by Todd Caspers

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 a 21-year-old was sampled in 2013, and we sampled 3, 20-year-old walleyes in 2016. We sampled 20-year-old fish in 2017 and 2021 as well.

We conducted our Standard Adult Sampling on Devils Lake in July. Preliminary results showed the overall CPUE of walleye increased significantly to about 32 walleye/net-night in our 125' variegated gill nets. (20 last year) This year's catch is above the long-term average of about 21 walleye/net-night. One thing that was encouraging was that the catch rate of Q-P sized walleye was up significantly to nearly 11 this year, which is well above the catch of about 4 for the last several years and also well above the long-term average of about 5.7. The northern pike were well below the long-term average again, while yellow perch numbers were above average. White bass numbers were still well above average. Most of the white bass are from the strong hatch that we observed in 2015, and they are mostly about 14 to 16 inches long now, although a fair number of yearlings were sampled as well. Due to relatively low numbers of 15"-20" walleye the past few years, we decided to stock walleye in 2021. About 575,000 fingerling walleye were stocked in 2021. We observed good results from our young of the year netting survey in September, with about 45 young walleye being caught per net, which is well above the average of about 24. Overall, we've observed 6 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 relatively well too. We conducted our Standard Adult Sampling there in late June. The walleye population appears to be doing fine, as our catch rate was about 19 walleye per net, which is above the long-term average of about 17.5 walleye per net. The northern pike were below their long-term averages, whereas yellow perch and white bass numbers were above average.

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, some waters had receded to the point where there were concerns about them, but the fall of 2019 was very wet and many waters refilled. 2020 brought dry conditions again though and brought back concerns for some waters. Most areas of the state have again experienced drought conditions during 2021, further increasing the concerns associated with lower water levels. Statewide, there are about 425 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 205 waters that have walleye populations. About the only place where walleye are not doing so well is the Missouri River system below Lake Sakakawea. This is due to habitat degradation and poor forage production since the flood of 2011. Conditions are improving, but there are still some areas where the walleye populations are still in tough shape, such as in the Garrison Reach where growth and size structure are still poor.

Our state record for walleye was broken again in 2021. In 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 walleye fingerlings in 133 lakes in 2021. About 8.6 million fingerlings were stocked by our department. The fingerlings were generally about 30 days old and were around 1.25” long. Fry stockings were also used in 17 waters, totaling about 5.6 million fry.

In addition to the known zebra mussel populations in the Red River, Lake Ashtabula and the lower Sheyenne River, and Lake LaMoure, zebra mussels were also discovered in Twin Lake and Lake Elsie this year.

South Dakota 2022 Winter Walleye Technical Committee Report submitted by Mark Fincel

MO River Impoundment Projects:

Lake Sharpe/Oahe Tagging Project (PIs Laurel Sacco, Tanner Davis, Eli Felts)

To date, 1,023 reward and 13,736 non-reward jaw tags have been attached to walleye in Lake Sharpe. Of these, anglers have reported 253 reward and 2,254 non-reward tags from the project's beginning in 2017 to present (January 2021). Exploitation, tag loss, and reporting estimates are forthcoming.

Using Burnham models, we have obtained monthly survival walleye estimates associated with angler harvest in Lakes Sharpe and Oahe for two 5-year periods (2017-2022 and 2013-2018, respectively). Our results suggest that survival in each reservoir is influenced by walleye length, sex, and size class. The strongest relationship we found showed increasing survival with length in fish over 20 inches while survival of walleyes less than 20 inches decreased with length. This relationship may be driven in part by the pattern of increased survival of larger female walleyes – female survival was highest in fish over 20 inches. These patterns were similar for both reservoirs and were more pronounced in Oahe.

We used multistate models to investigate the monthly escapement probabilities for walleye and Lakes Sharpe and Oahe for two 5-year periods (2017-2022 and 2013-2018, respectively). Our initial results show higher rates of escapement through Big Bend Dam compared to Oahe Dam. Escapement probability increased with outflow at Big Bend and was highest during the high flows in 2018 and 2019. This pattern was reversed at Oahe, and escapement seemed to decrease as dam outflow increased. Our results may have been influenced by differences in weather patterns between the two time periods (i.e., 2013-2018 were average to low flow years). Additionally, structural differences between Oahe and Big Bend Dams may be influencing survival and detection rates of entrained fish.

WAE Post Stocking Evaluation Project (PIs Kyle Olivencia, Mike Weber)

This research is focused on post-stocking predation of age-0 Walleye by adult Smallmouth Bass and diet/isotopic overlap between adult Walleye and adult Smallmouth Bass. In 2019, Smallmouth Bass consumed a small percentage (~7%) of age-0 Walleye stocked into Lake Oahe. Up to 11.1% of Smallmouth Bass diets contained age-0 Walleye and those Smallmouth Bass that consumed age-0 Walleye ranged from 209-416mm. Highest proportion of age-0 Walleye in Smallmouth Bass diets occurred within 3 days after stocking and lasted up to 25 days. Results of post stocking predation of age-0 Walleye by Smallmouth Bass in 2021 and diet/isotopic overlap results for 2019 and 2021 are still being analyzed.

Lewis and Clark Telemetry Project (PIs Will Radigan, Mark Pegg)

Beginning in spring 2021, we started a walleye acoustic telemetry study on Lewis and Clark Lake, the smallest of the Missouri River impoundments. We surgically implanted 42 acoustic-tags in walleye throughout Lewis and Clark Lake and have 12 receivers in the lake to monitor movement patterns. In the first 7 months, eight were harvested and 1 walleye was entrained through Gavins Point Dam and picked up by USGS receivers below the dam. From March to September, average movement for a tagged female walleye was 16 miles downstream and 2 miles upstream, while the average movement for a tagged male walleye was 20 miles downstream and less than 1 mile upstream. Sex-specific differences in movement patterns are evident, with 60% of female walleye moving less than 10 miles, and 32% of male walleye moving less than 10 miles.

West River Projects:

West River Tagging Projects (PIs Laurel Sacco, Cade Lyon)

We evaluated the effects of current harvest regulations on Walleye populations in three reservoirs in western South Dakota: Angostura, Belle Fourche, and Shadehill. In 2018, a jaw-tagging study was initiated to estimate angler exploitation in each reservoir. Shadehill had the highest exploitation in 2018 (32.4%) and Angostura had the highest exploitation in 2019 (37%). In addition, Walleye were randomly sampled, and sagittal otoliths were collected to estimate growth and mortality in each reservoir. Walleye in Angostura exhibited the highest growth rates of the three reservoirs evaluated in this study. Total annual mortality (A) and

the instantaneous rate of total mortality (Z) was also highest in Angostura. Fisheries Analysis and Modelling Simulator (FAMS) was used to model impacts of current and potential harvest regulations. For all reservoirs, yield (kg) was highest when modeled with a 381 mm minimum length limit. The highest yield was produced in Angostura given angler exploitation of 28.6% and a harvest regulation of 381 mm MLL. Results from this study reveal that Angostura reservoir produces a highly productive Walleye population that experiences significant angler exploitation.

Hooking mortality Project (PI Cade Lyon)

We evaluated effects of capture depth and water temperature on hooking mortality of Walleye *Sander vitreus* in three South Dakota reservoirs. The study was split into two angling seasons: an ice fishing season that was conducted on Lake Sharpe and Lake Oahe in February of 2020, and an open water season on Belle Fourche Reservoir in July of 2020. After angling, Walleye (n=130) were placed into holding pens for 12 to 72 h to monitor post-release mortality. During the ice fishing season, hooking mortality of Walleye was 20%. In contrast, no hooking-related mortalities were observed among Walleye during the summer season. Using logistic regression and AIC model selection I found that capture depth, fishing season, and air exposure were the most influential variables on mortality. Walleye were generally caught from deeper depths in winter (10.9 m, SE=0.16), compared to summer (6.7 m, SE=0.33) and were exposed to air for longer during winter (83.9 s, SE=8.22) versus summer (55.3 s, SE=2.49). I observed a sharp increase in probability of mortality (P_m) with capture depth, where P_m ranged from 3% at 10 m to 38% at 12 m. Results from this study indicate that hooking mortality needs to be considered when implementing length-based regulations, especially in lakes where Walleye angling occurs at depths greater than 10 m.

Wisconsin 2022 Winter Walleye Technical Committee Report submitted by Lawrence Eslinger

1. **Wisconsin Walleye Management Plan Update** – submitted by WDNR Biologist, Max Wolter

Wisconsin is in the process of updating the state's walleye management plan (original version from 1998). We have completed the initial stage of public input and have a draft plan that is in review internally. We hope to be able to share that draft with the tribes, public, and other agencies within the next few months. There will be another round of public comment and then the plan will go to the state Natural Resource Board for final approval. The current draft has goal areas centered around habitat, opportunities, data/monitoring, outreach/communication, stocking, partnerships, and rehabilitation/climate change, in addition to statewide and local issue statements. A public opinion survey was conducted in conjunction with the planning effort. The report for the public opinion survey can be found here: https://widnr.widen.net/s/lhgfhk7npn/fishmanagementreport159

2. **Wisconsin Walleye Initiative (WWI)** – submitted by WDNR Fisheries Staff Specialist, Joe Hennessy

Between 2013-2015 WDNR switched its primary walleye stocking product from small fingerlings (stocked in June at ~1.5") to fall fingerling walleye (stocked in September October at 6-8"). The change occurred statewide across more than 300 receiving waterbodies and allowed WDNR to design a massive in-situ adaptive management experiment. The primary goals of walleye stocking in Wisconsin are 1) if possible, restore natural walleye reproduction in systems where it was historically present and 2) develop and maintain fishable walleye populations (greater than 1.5 adult walleye/ surface acre. Now, eight years after the original stocking events, WDNR is beginning the process of a large statewide stocking evaluation, and measuring return to adulthood of stocked fish. This process will continue between 2021-2027. Broadly, the state is examining the efficacy of various stocking densities (5, 10, 15, and 20 fall fingerlings/ surface acre), and looking for systems where stocked fish have begun to have successful natural reproduction (three, to date). Systems where at least three stocked year classes have reached sexual maturity will be surveyed during the six-year study period; in total the plan will include more than 120 mark-recapture population estimates. In lakes where there is the potential for both stocked an native fish to be contributing to the adult population, genetic parentage analysis will be used to portion the relative contributions. Wisconsin maintains a database of all pairs of walleye used to contribute eggs to its hatchery system to enable this approach.

3. **WDNR Hatchery Walleye Production** – submitted by WDNR Biologist, Ryen Kleiser

Hatchery walleye production numbers over the past 3 years 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.

Year	**Age Class**		
	Fry	**Small Fingerling**	**Large Fingerling**
2019	24,490,521	2,162,148	780,105

2020	0	313,649	809,010
2021	19,060,271	1,190,710	835,005

4. **Walleye Regulation Changes for upcoming 2022 fishing season –** provided by WDNR Policy Specialist, Meredith Penthorn

Waters Impacted	**Walleye Regulations**
Minocqua Chain (Minocqua, Kawaguesaga, Mid, Jerome, Mud, Little Tomahawk, Tomahawk lakes and connecting waters combined), Oneida County	Catch-and-release only until 2025
Escanaba Lake, Vilas County	Season from second Saturday in June to the first Sunday in March. Ceded Territory regulation (3-fish daily bag limit, 15" minimum length limit with 20-24" protected slot and only 1 over 24") until an annual quota (in pounds) is reached, and then catch-and-release for the remainder of the season.
Lake Laura, Anvil Lake, Katherine Lake, Clear Lake, Oneida and Vilas counties	18" minimum length limit, 22-28" protected slot, daily bag limit of 1
Flambeau River between Turtle-Flambeau Dam and Thornapple Flowage Dam and its tributaries upstream to the first lake, dam or fish refuge, Crowley Flowage, Elk River, Grassy Lake, Lac Sault Dore, Lower Park Falls Flowage, Phillips Chain (Duroy, Elk, Long and Wilson lakes and connecting waters combined), Pike chain of lakes (Amik lake, Pike lake, Round lake, Turner lake and connecting waters combined), Pixley Flowage, Solberg Lake (including its tributaries upstream to the first dam or lake), South Fork Flambeau River, Upper Park Falls Flowage, Big Falls Flowage, Dairyland Reservoir, Ladysmith Flowage, Thornapple Flowage; Ashland, Iron, Price, Rusk, Sawyer and Vilas counties	Ceded Territory regulation (3-fish daily bag limit, 15" minimum length limit with 20-24" protected slot and only 1 over 24")
Black Dan Lake, Island Lake, Sand Lake, Sawyer County	Ceded Territory regulation (3-fish daily bag limit, 15" minimum length limit with 20-24" protected slot and only 1 over 24")
Lake Menomin, Dunn County	Ceded Territory regulation (3-fish daily bag limit, 15" minimum length limit with 20-24" protected slot and only 1 over 24")

In December 2021, the previous emergency catch-and-release only walleye regulation on the Minocqua Chain of Lakes, Oneida County, transitioned into a permanent rule. This rule specifies that the catch-and-release only regulation of walleye will be enforced through the 2024-25 angling season. Upon the start of the 2025-26 angling season, the rule will be replaced with an 18" minimum length limit, 22-28" protected slot, daily bag limit of 1.

5. **Wisconsin DNR Office of Applied Science – Fisheries Research Program – Walleye Research** – submitted by WDNR Program Supervisor, Dr. Greg Sass

- **10-year evaluation of 50% annual exploitation on Sherman Lake, WI**. Completed in 2016, 10 years of 50% annual exploitation on the walleye population in Sherman Lake resulted in no change in adult, female, male, and age-0 walleye density, increases in juvenile growth rates, declines in length at maturity, and a reduction in population size structure. Age-1 relative abundance was higher and more variable in Sherman Lake compared to the reference lake during elevated exploitation suggesting increased survival. The Great Lakes Indian Fish and Wildlife Commission were collaborators. This study was published in the North American Journal of Fisheries Management in 2021.

  Sass, G.G., S.L. Shaw, L.W. Sikora, M. Lorenzoni, and M. Luehring. 2021. Plastic abundance and demographic responses of walleye to elevated exploitation in a north-temperate lake. North American Journal of Fisheries Management DOI:10.1002/nafm.10716.

- **Walleye genetic pedigree analysis of the Sanford and Escanaba Lake, WI walleye populations**. Beginning in 2016, WDNR fisheries research has collaborated with Dr. Wes Larson and Dr. Jared Homola of the Wisconsin Cooperative Fishery Research Unit at UWSP to genetically link age-0 and age-1 walleye with individual parental walleyes and spawning habitat. Preliminary results suggest that larger, older females may be disproportionately contributing to the survival of age-0 fish to their first fall. The SNP panel for walleye was completed in 2019 and published by Matt Bootsma et al. (2020) in Molecular Ecology Resources. UWSP graduate student Levi Simmons will be conducting the walleye pedigree analysis for both lakes for his M.S. thesis. Results and thesis completion are anticipated in spring 2022.

  Bootsma, M., K.M. Gruenthal, G. McKinney, L. Simmons, L. Miller, G.G. Sass, and W.A. Larson. 2020. A GT-seq panel for walleye (*Sander vitreus*) provides a generalized workflow for efficient development and implementation of amplicon panels in non-model organisms. Molecular Ecology Resources 20:1706-1722.

  DOI:10.1111/1755-0998.13226.

- **Resolving genetic management units for Wisconsin walleye**. UWSP M.S. graduate, Matt Bootsma, Dr. Wes Larson, and WDNR fisheries research completed and published this analysis in Evolutionary Applications in 2021. The use of genomics improved the spatial-structure of walleye genetic strains in Wisconsin compared to the use of allozymes or microsatellites and will be used as the basis for stocking guidance.

  Bootsma, M.L., L. Miller, G.G. Sass, P. Euclide, and W.A. Larson. 2021. The ghosts of propagation past: haplotype information clarifies the relative influence of stocking history and phylogeographic processes on contemporary population structure of walleye (*Sander vitreus*). Evolutionary Applications 14:1124-1144.

  http://dx.doi.org/10.1111/eva.13186.

- **Does woody habitat addition increase walleye production?** Beginning in 2015, a long-term study was initiated to test whether the addition of trees to a lake increases fish production, including the production of walleye. Pre-manipulation monitoring of the fish community and aquatic ecosystem has been completed and 160 trees were added to Sanford Lake in June 2018. Fish and aquatic ecosystem monitoring is ongoing to test for responses to the habitat addition.

  Sass, G.G., S.L. Shaw, T.P. Rooney, A.L. Rypel, J.K. Raabe, Q.C. Smith, T.R. Hrabik, and S.T. Toshner. 2019. Coarse woody habitat and glacial lake fisheries in the Midwestern USA: knowns, unknowns, and an experiment to advance our knowledge. Lake and Reservoir Management 35(4):382-395. DOI:10.1080/10402381.2019.16305309.

- **Does woody habitat addition influence walleye behavior**. As part of the woody habitat addition influences on walleye production study, University of Minnesota-Duluth M.S. graduate, Quinn Smith, in collaboration with Dr. Tom Hrabik and WDNR fisheries research is using radio telemetry and PIT-tag receivers to monitor walleye behavior in relationship to the woody habitat addition. Preliminary results suggest that woody habitat addition had minimal influences on walleye behavior; however, home range sizes for walleye marginally increased after woody habitat addition. This research was published in Ecology of Freshwater Fish in 2021.

  Smith, Q.C., G.G. Sass, T.R. Hrabik, S.L. Shaw, and J.K. Raabe. 2021. Sportfish behavioral responses to a littoral coarse woody habitat addition in a north- temperate lake. Ecology of Freshwater Fish https://doi.org/10.1111/eff.12643

- **Whole-lake centrarchid removal to improve walleye recruitment**. In collaboration with the Wisconsin Cooperative Fisheries Research Unit at UWSP and the Center for Limnology, UW-Madison, a whole-lake centrarchid removal project was initiated in 2017. Because anecdotal evidence has suggested that abundant largemouth bass populations may negatively affect walleye populations, this whole-lake removal of centrarchids will test whether the removal of a substantial portion of the bass/panfish family improves walleye natural recruitment. Following a year of baseline monitoring of the fish and aquatic community, centrarchid removals were conducted in 2018, 2019, and 2020 and monitoring of the fish community and walleye recruitment responses are ongoing. A summary of the current study results has been provisionally accepted in Fisheries Management and Ecology.

  Embke, H.S., S.R. Carpenter, D.A. Isermann, G. Coppola, T.D. Beard, A.J. Lynch, G.G. Sass, Z.S. Feiner, and M.J. Vander Zanden. Resisting ecosystem transformation through an intensive whole-lake fish removal experiment. Fisheries Management and Ecology (provisionally accepted).

- **Walleye comparative recruitment study**. Beginning in summer 2017, a 5-7 year comparative walleye recruitment study was initiated with Great Lakes Indian Fish and Wildlife Commission biologists. The project aims to measure within-lake and watershed characteristics from a suite of lakes throughout northern Wisconsin with stable walleye recruitment and in those where natural recruitment has declined over time. The goal of this study is to test for differences between the lake types and to identify applied management actions that could be applied to improve walleye natural recruitment. As of 2021, we have 4 years of data on 41 lakes (no additional lakes were added in 2020 due to COVID). Preliminary results of *in-situ* habitat characteristics were non-significant, but there were some initial trends observed in shoreline development and coarse woody habitat availability (declining = more development on average and less wood) as well as aquatic vegetation coverage. Coverage of aquatic plants was similar in declining and stable lakes, but declining lakes had a higher biovolume

of vegetation relative to stable lakes. Analysis of lakes with 7 or more years of recruitment data confirms decreases in survival of age-0 walleye in lakes labeled as declining. As the project continues, more lakes will be added and there are plans to evaluate temporal trends in riparian habitat of study lakes, estimate spawning habitat availability as well as thermal optical habitat availability. The age-1 walleye index of abundance was published in Fisheries Management and Ecology in 2020.

Shaw, S.L. and G.G. Sass. 2020. Evaluating the relationship between yearling walleye,*Sander vitreus*, electrofishing catch per effort and density in northern Wisconsin lakes. Fisheries Management and Ecology 27:544-549. DOI:10.1111/fme.12449.

- In 2021, OAS research scientists in collaboration with WDNR Fish Management Veterinarians and WDNR and Tribal Hatchery Managers initiated a project to investigate the sex ratios of extended growth walleye fingerlings. This project was initiated after preliminary reports of sex ratios favoring females from 1 hatchery in 2019 (n=50 fish) and 3 hatcheries in 2020 (n=50 fish/hatchery). Samples were collected at stock-out and sex was classified based on the presence or gametes of any stage (generally spermatogonia for males and primary oocytes for females). Initial samples included only confirmed female and undifferentiated fish, no males were confirmed. (A scientific Note documenting these preliminary results was recently accepted for publication in the North American Journal of Aquaculture but is not yet published. Sass et al. 2022. Article DOI: 10.1002/naaq.10237). The project initiated in 2021 is currently slated for 2 years. Primary objectives include 1) documenting age and size of sexual differentiation for both males and females; 2) evaluating the environmental factors that may influence sexual differentiation both natural (e.g., temperature, pH, rearing density) and chemically induced (e.g., endocrine disrupting or mimicking compounds and hormone profiles or rearing and source water); and 3) evaluating temporal trends in adult sex ratio of lakes stocked with different hatchery products (i.e., fry, small fingerling, and extended growth) as well as wild population sex ratios. 2021 included monthly fish sample collection from several hatcheries (state, tribal, academic) to document gonad development via histology. We collected 2 water samples from 5 representative hatcheries (1 source water and 1 pond water sample) for a full hormone profile as well as bisphenol and alkylphenol chemical profiles. Results are pending sample processing.

- **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 20,000 adult and 100,000 age-0 bullhead were removed from Howell Lake in 2020. This study is being conducted by UWSP M.S. student, Logan Sikora, Dr. Justin VanDeHey, and WDNR fisheries research and management. 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.

Sikora, L.W., J.A. VanDeHey, G.G. Sass, G. Matzke, and M. Preul. 2021. Fish

community changes associated with bullhead removals in four northern Wisconsin lakes. 2021. Proceedings of the Catfish 2020; 3rd International Catfish Symposium. North American Journal of Fisheries Management 41:S71-S81. DOI:10.1002/nafm.10594.

- **Depensation in Wisconsin walleye populations**. Depensation, or elevated age-0 mortality rates at low adult stock size, was tested for in about 80 Wisconsin walleye populations. Results suggested that about half of the walleye populations examined showed depensatory recruitment dynamics. This suggests that a critical adult density threshold exists such that reductions in stock size below this level will result in failed recruitment

without intervention. This study was published in Fisheries in 2021 by WDNR fisheries research scientists, Dr. Greg Sass, Dr. Zach Feiner, and Dr. Stephanie Shaw.

Sass, G.G., Z.S. Feiner, and S.L. Shaw. 2021. Empirical evidence for depensation in freshwater fisheries. Fisheries 46(6):266-276. **DOI:**10.1002/fsh.10584.

- **Walleye spawning phenology related to climate change**. WDNR fisheries research scientist, Dr. Zach Feiner, is testing for the influences on climate change on walleye spawning phenology and subsequent recruitment responses. This study is ongoing and preliminary results suggests that walleye have been spawning earlier over time. In addition, a collaboration among WDNR fisheries research and UW-Madison, Center for Limnology scientists is examining the influence of high ice off variability on walleye recruitment. A perspective on climate change phenological effects on aquatic ecosystems and walleye has been provisionally accepted in the Canadian Journal of Fisheries and Aquatic Sciences.

Feiner, Z.S., H.A. Dugan, N.R. Lottig, G.G. Sass, and G.A. Gerrish. 2022. A perspective on the ecological and evolutionary consequences of phenological variability in north-temperate lakes. Canadian Journal of Fisheries and Aquatic Sciences (provisionally accepted).

- **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, yellow perch, and adult walleye, while subsequently removing rainbow smelt during spring spawning. This research is ongoing and cisco were stocked into Sparkling Lake in fall 2020 and 2021.

- **Black crappie and walleye interactions**. An ongoing WDNR fisheries research study is testing for relationships between black crappie and age-0 walleye. Preliminary results suggest a strong, negative interaction between the species such that walleye age-0 recruitment is always low when black crappie relative abundance is high. A manuscript of this research will be submitted to the North American Journal of Fisheries Management in spring 2022.

- **Compensatory density-dependent mortality between age-0 and age-1 walleye**. An ongoing fisheries research study is examining density-dependent mortality between age-0 and age-1 walleye in Ceded Territory of Wisconsin lakes. Density-dependent mortality of age-0 walleye was highly evident. Ongoing research is testing for abiotic and biotic covariates that may explain additional variability in this relationship. A manuscript of this research will be submitted to Ecology of Freshwater Fish in spring 2022.

- **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 RAD tool for walleye (Sander vitreus) management in Wisconsin** – submitted by WDNR Fisheries Research Scientist, Collin Dassow

  In Review with Journal of Fisheries Management and Ecology
  The impacts of climate change on recreational fisheries will not be equally distributed across all species and waterbodies. While large-scale modeling and prediction provide insight into general impacts of climate change on inland recreational fisheries, small-scale dynamics and local expertise will be key in developing explicit goals for managing recreational fisheries in the face of a warming climate. The resist-accept-direct (RAD) framework encompasses the entire decision space managers consider when addressing climate impacts in their local system, but to decide whether to resist, accept, or direct in their local systems managers need tools to understand how specific systems will be impacted by climate change. Here a decision-support tool was developed and applied to the walleye recreational fishery in the state of Wisconsin, USA as an example of how to link the RAD framework to real-world management of a recreational fishery.

6. **Evaluation of adult Walleye exploitation in accordance with shifting management regimes in Wisconsin's Ceded Territory Lakes –** submitted by WDNR Treaty Data Coordinator, Tom Cichosz

   We are assessing walleye exploitation from 1990 through 2020 in the mixed (spearing and angling) walleye fishery in the Wisconsin Ceded Territory to evaluate if adult walleye exploitation rates were effectively managed to prevent exceedance of an established benchmark, and if that effectiveness has changed with changing management regimes over time. The guiding benchmark for Ceded Territory walleye management incorporates both a management objective and a prescribed risk criterion, stating that total adult walleye exploitation should not exceed 35% more than 1 time in 40.

   Earlier studies (Cichosz 2017; Beard et al. 2003) evaluated the efficacy of the sliding bag system previously utilized for managing adult walleye exploitation in the Wisconsin Ceded Territory. In 2015 a new management system utilizing a standardized bag limit (3 walleye/day) with more restrictive angler harvest regulations replaced the sliding bag limit system as the primary means to regulate angler harvest in the joint fishery. At the same time WDNR largely ceased use of a no-minimum size restriction for management of angler harvest of adult walleye, moving toward the use of more restrictive size limits to accomplish similar biological goals (e.g. No minimum size with only 1 fish >14" or a No minimum size with a 14-18" protected slot). In 2016 WDNR also began using a Mixed Effects Model (MEM) for setting of safe harvest levels (used to guide tribal spear and net harvest) in most Ceded Territory waters – relative to the previous linear regression models used, this MEM was expected to allow more- or less tribal harvest in documented high- or low-density fisheries, respectively (Hansen et al. 2015).

   Since the standardized walleye 3-bag, discontinued use of the no-minimum size regulation and implementation of the MEM were implemented in similar timeframes and are now used concurrently, it is not feasible to separate impacts of each on adult walleye exploitation rates. The combined effect of these measures will be considered the current management regime and compared to management performance in recent (2010-2014) and historic (1990-2009) years under the prior management regime.

7. **Stocking practices and lake characteristics influence probability of stocked Walleye survival in Wisconsin's Ceded Territory lakes –** submitted by WDNR Biologist, Zach Lawson

31-year Walleye fingerling stocking evaluation in Wisconsin's Ceded Territory lakes. Walleye stocking has grown in popularity to mitigate regional walleye fishery declines as shown by an average of 160 lakes per year in the 1980s, compared to 223 lakes per year in the 2010s. We integrated 31 years of stocking and electrofishing data with lake habitat characteristics to identify factors that influence stocked fingerling survival, measured by the number of individuals stocked compared to those sampled in stocking evaluation surveys. Notably, 21% of stocking events exhibited zero returns in the following year. To handle the prominence of zeros, we used a zero-inflated mixed effects model to test for effects of stocking practices and lake attributes along with lake-level random effects. Results suggest that the average length and stocking density are important stocking practice-level characteristics, while water clarity, water temperature and lake surface area are important lake-level characteristics for predicting survival. Additionally, and concerningly, we found a significant reduction in stocked fingerling survival through time. Although overall survival of stocked fingerlings is relatively low, better understanding stocking efficacy can help managers weigh factors when determining whether stocking is worthwhile, make more informed decisions to maximize utility of limited resources, and shepherd realistic expectations among fisheries professionals and the public. This study was published in North American Journal of Fisheries Management special issue on Percids and system change in 2021 by WDNR fisheries biologists Zach Lawson, Dr. Alex Latzka, and Lawrence Eslinger.

8. **Lake Winnebago System Management Project Updates –** submitted by WDNR Biologist, Adam Nickel

We are in our 5th and likely final year of the walleye reward tag study. In conjunction with our normal non-reward floy tagging each year, we also tagged 100 adult female and 100 adult male walleye with pink reward floy tags on the Wolf River during spring electrofishing surveys. Average angler tag reporting rate for the study is 33.2% with a range of 24.8%-40.8% (27.6% in 2016, 40.8% in 2017, 34.3% in 2018, 24.8% in 2019, and 38.4% so far in 2021). Once this year of the study is finalized we will be working with Stevens Point on data analyses and article drafting. The study was crucial for correcting angler tag reporting rate and exploitation estimates for walleye on the Winnebago System and is also being used by others statewide for other waterbodies.

We also just got started on a new sonic tagging study on the Winnebago System to evaluate adult walleye movement and habitat use on the system including the Wolf and upper Fox Rivers. Although the Wolf River holds some of the most productive walleye spawning marshes on the Winnebago System, walleye have also historically made spawning runs on the upper Fox River, and occasionally spawn along Lake Winnebago shorelines. Although past survey efforts and studies indicate that good numbers of walleye utilize the Wolf River for spawning, it is still unknown what percent make spawning runs up the Wolf River, upper Fox River, or stay in Lake Winnebago. Further understanding walleye habitat use on the Winnebago System is critical for guiding management and habitat restoration efforts. The upper Fox River walleye spawning run has become less substantial and predictable in recent years. Fishways have also been installed to improve fish passage including at Eureka in 1993 and more recently in Princeton and Montello. Many of the historical walleye spawning marshes are located downstream of Princeton on the upper Fox River, but walleye should now have access to upstream reaches with the recent Princeton and Montello fishways. Therefore, it is important to evaluate if walleye movement and habitat use has changed on the upper Fox River. Downstream movement of walleye to the lower Fox River and Green Bay that are produced from the Winnebago System has been documented. Therefore, management and habitat restoration efforts on the Winnebago System likely also has some benefit to downstream populations.

During fall of 2021, DNR staff tagged 74 fish with internal sonic tags on Lake Winnebago during electrofishing surveys in several areas including Black Wolf (24), Grundman County Boat Landing (19), Asylum Bay (14), Paynes Point (13), Pipe (3) and Fond du Lac (1). In addition, the upper Fox River receiver network was expanded upstream to Portage and staff are also working to install 20 releasable acoustic receivers on Lake Winnebago as part of the

study. For 2022, staff will focus tagging efforts on Lake Puckaway and the upper Fox River. We also have tagged fish with $100 reward loop tags to help ensure that we receive information regarding harvested fish in the study and have the potential to reuse sonic tags. This study is currently being funded by the Department, NRDA, Walleyes for Tomorrow, and Sheboygan Walleye Club. Below is the message we send out to anglers for tag reporting.

All sonic tagged fish are also marked with an orange loop tag near the dorsal fin that reads, RESEARCH REWARD. Anglers that happen to catch a sonic tagged fish are asked to record the tag number information and approximate length, take a picture with the fish and close up of both sides of the loop tag showing the number, and report their catch. If the fish is released please leave the loop tag intact. If the fish is harvested please contact the DNR, the internal sonic tags have a 3 year battery life and may be able to be reused. Anglers that report the catch or harvest of a loop tagged fish and have proper confirmation (the physical loop tag or picture with fish and verifiable loop tag number) will receive a $100 reward (reward expires Dec. 31, 2025). To report tags and catch information, anglers can email the information to DNRWINNEBAGOSYSTEMTAGRETURNS@wisconsin.gov, call 920-303-5429, or mail to the Oshkosh DNR office (625 East County Road Y, Oshkosh WI 54901).

9. **Walleye Management Projects in Peshtigo River Impoundments –** submitted by WDNR Biologist, Chip Long

Walleye Acoustic Telemetry in High Falls Flowage; Marinette County, WI

The primary objective of this study is to determine the timing and duration of the upstream spawning migration within the flowage. Fish managers have been unsuccessful at generating a meaningful walleye population estimate or adequately characterize the fishery. It is assumed that adult walleye density is increasing due to increased stocking of large fingerlings (15/acre in alternate years) over the last 8 years and the addition of a protected slot limit. This project also aims to locate alternative spawning locations which would allow for more targeted and efficient collection of adult walleye in future surveys.

Walleye Escapement from the Peshtigo Flowage; Marinette County, WI

The Peshtigo Flowage is the last of 6 impoundments on the Peshtigo River. In 2021, a permanent pit tag array was installed below the last dam to monitor the presence and abundance of spawning lake sturgeon from Green Bay. Stocking fish in systems with minimal retention time could lead to emigration from the original stocking location. Therefore, in 2021 1,200 large fingerling walleye were pit tagged and planted in the Peshtigo Flowage. One half (600 walleye) were stocked 1 mile above the dam and the remaining 600 walleye were stocked 4 miles upstream. Within 8 days, walleye from the stocking location 4 miles upstream were detected below the dam on the downstream pit array. While the preliminary results support managing “open” fisheries within appropriate genetic management units, identifying environmental triggers to downstream movement would allow fish managers to modify stocking strategies.

10. **St. Louis River Walleye Population Dynamics –** submitted by WDNR Biologists, Kirk Olson and Paul Piszczek

In 2015 we were able to get a reliable adult PE on this large, open system by sampling spawning grounds over the entire run period and used POPAN models in MARK that account for movement in and out of the spawning grounds. A concurrent creel survey, completed cooperatively by WI and MN DNR agencies, allowed us to get a pretty solid

estimate of exploitation as well. We also used stable isotope of C and N from fin samples to identify that a substantial portion of the population was relying on prey out in Lake Superior, making them potentially vulnerable to harvest in the lake, both commercial and sport. Additional project details can be found within the following online report:

https://p.widencdn.net/igfw7y/Manage_FH156

This survey was completed again during spring 2021, and methods are being replicated to compute an updated adult walleye population estimate this winter. The intent is to repeat the survey every five years to create a strong quantitative method to describe population trends. However, creel survey and isotope work were not repeated in 2021. We made five to seven electrofishing passes with maxi-booms every day during most of the five-week run. All fish were marked with individually numbered Floy tags and were presumed at-large throughout the survey period, as the survey was conducted prior to the fishing season opener. This was a joint survey with our border water partner, Minnesota DNR.

11. **Biomanipulation Efforts to Aid Walleye Recoveries –** submitted by WDNR Biologist, Greg Matzke

Bullhead Removals to Increase Walleye Abundance and Recruitment:

Walleye natural reproduction averaged 2.8/mile and 8.4/mile for the five years prior to large scale black bullhead removals on Lake Metonga (Forest County) and Patten Lake (Florence County). After bullhead removals, natural reproduction has averaged 36.4/mile and 105.8/mile on Lake Metonga and Patten Lake. The adult walleye population responded accordingly bringing walleye densities from 0.8/acre in 2007 to a mean density of 3.9/acre over the last three surveys on Lake Metonga. Adult walleye abundance also increased in Patten Lake, from 1.0/acre in 2011 to 3.0/acre in 2021. Substantial changes in the fish community were also observed in Patten Lake with major reductions of bluegill, largemouth bass, and northern pike; while walleye, yellow perch and smallmouth bass populations increased after the bullhead removal.

Largemouth Bass Removals to Increase Walleye Abundance and Recruitment:

As a response to major decreases in walleye abundance and recruitment, along with major increases in largemouth bass abundance, a largemouth bass removal project occurred on Jungle Lake (Forest County). This project has been underway since 2013, and while largemouth bass abundance has been kept at our target level there has still been no increase in walleye recruitment. Voluntary decreased tribal harvest and stocking of walleye has been able to stabilize the walleye population at just under 3 adults/acre. While walleye have not responded the way we had planned, the fishery has changed substantially with increased abundance of yellow perch, bluegill, black crappie, pumpkinseed, rock bass, and northern pike.

Bullhead Removals on a Centrarchid Dominated System to Improve Walleye Abundance:

Bullhead removals were conducted on the Pickerel-Crane Chain of lakes to test the effectiveness of bullhead removals to improve walleye populations. These waters were dominated by overabundant panfish, primarily

bluegill, and high densities of largemouth bass and northern pike. After bullhead removal the fishery of both of these lakes changed very quickly with relative abundance of bluegill dropping approximately 90% in both lakes, from 584 and 189/net-night to 52 and 25/net-night for Pickerel and Crane Lakes. Largemouth bass abundance in both lakes was also reduced as a result of the bullhead removal. Yellow perch recruitment increased and they became the dominant panfish species. Stocked walleye survival rate increased, but natural reproduction was not observed. Later a walleye spawning reef was installed on Crane Lake, and natural walleye reproduction was observed for the first time in approximately 35 years.

12. **Seasonal movement patterns of walleye in the Menominee River and Green Bay –** submitted by WDNR Team Supervisor, Mike Donofrio

    Menominee river walleye telemetry- Our staff are inserting 60 V13 size acoustic tags into Menominee river adult walleye from September 2020 through May 2022. The tags have a battery life of 800 days. The walleye were primarily captured at the Menominee dam fish lift then released at a separate site in the lower river. We have 7 receivers in the lower Menominee that can receive signals from these fish and nearly 100 receivers in GB. We download those receivers annually and collate that data. A report will be written at the conclusion of the project. Our objectives include: seasonal movement patterns in the Menominee, other GB tributaries and generally Green Bay and spawning site fidelity.

13. **Green Bay, Fox River walleye population assessments –** submitted by WDNR Biologist, Jason Breeggemann

    Two surveys targeting walleyes are conducted annually on the Lower Fox River and Lower Green Bay. In the spring, the lower Fox River is electrofished to evaluate age and size distribution of the adult walleye spawning population in the Lower Fox River. The goal is to capture, measure, and collect age samples (fin spines) from at least 500 adult walleyes. In the fall, the east and west shores of lower Green Bay and parts of the lower Fox River are electrofished for age-0 walleyes. Data is collected on all walleyes captured as well as on other species encountered.

14. **Better Understanding of Aquatic Habitats and Their Relationships With Walleye Reproductive and Recruitment Success in Northern WI Lakes** – submitted by WDNR Biologists, Lawrence Eslinger and Paul Frater

    Natural reproduction and recruitment success in walleyes is a topic of great concern and has been declining regionally across lakes in northern Wisconsin over recent decades. We used fall walleye recruitment surveys in conjunction with aquatic macrophyte surveys to assess trends between natural walleye recruitment and the percentage of a lake's area where aquatic plants were present. Using a negative binomial generalized linear model we found a significantly decreasing trend between age 0 walleye CPE and aquatic plant prevalence in lakes with self-sustaining walleye populations. In addition, we developed a novel approach for determining preferred walleye spawning areas using nearshore substrate data collected during shoreland habitat assessments. While these efforts are still works-in-progress, we hope to continue to refine and develop them to aid in better understanding the structural aspects of aquatic habitats that promote natural walleye reproductive and recruitment success in northern Wisconsin lakes.

15. **Molecular Conservation Genetics Laboratory; Wisconsin Cooperative Fishery Research Unit; University of Wisconsin – Stevens Point**
    Submitted by Dr. Jared Homola

Over the past year, the Molecular Conservation Genetics Laboratory at University of Wisconsin – Stevens Point has advanced efforts to facilitate parentage-based tagging (PBT) as a walleye management tool throughout Wisconsin. PBT involves genetic assignment of wild caught walleye back to a reference database containing genetic information for broodstock previously used in hatchery production. This process provides a means of differentiating naturally produced from hatchery-reared walleye for informing stocking assessments and assessing stocking success as a function of factors such as broodstock source, recipient waterbody, or specific hatchery practices. High confidence assignments to parental broodstock samples is enabled by a genotyping-in-thousands (GT-seq) panel developed specifically for walleye throughout the upper Midwest. PBT assessments performed in 2021 involved eight lakes throughout Wisconsin with hatchery contributions ranging from 0-100%. Efforts to grow the reference database of broodstock samples, including collecting fin clips from all broodstock walleye, occurred in 2021 and will continue into the future.

16. **Wisconsin Cooperative Fishery Research Unit; University of Wisconsin – Stevens Point**
Submitted by Dr. Dan Isermann

Walleye and Yellow Perch in Northern Wisconsin Lakes: Recruitment Trends and Importance of Perch as Prey for Larval Walleye

Submitted by AnaSara Gillem, Wisconsin Cooperative Fishery Unit, University of Wisconsin-Stevens Point; Daniel Isermann, USGS-Wisconsin Cooperative Fishery Unit, University of Wisconsin-Stevens Point Contact: dan.isermann@uwsp.edu

The objectives of this study are to determine if the following differ between lakes with different Walleye recruitment histories (sustained vs. declined): 1) density and spatial distribution of zooplankton prey; 2) relative importance of larval Yellow Perch and zooplankton to larval and post-larval Walleye diets; and 3) trends in age-0 Yellow Perch abundance. Larval Walleye as small as 9 mm had fish present in their diets. Densities of larval Yellow Perch were not significantly different between recruitment histories; however, relative abundance of age-0 Yellow Perch was significantly different between recruitment histories in June-July, with higher perch catch rates in lakes with sustained walleye recruitment and this trend generally held through October despite lack of statistical differences. Sampling will continue in 2022 using several different gears to target Walleye and Yellow Perch in their first few months of life.

Assessing abundance of small centrarchids and yellow perch (< 100 mm TL) in northern Wisconsin lakes with different walleye recruitment histories

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

Our goals were to identify gears that can be used to effectively sample small centrarchids and yellow perch to determine if current and historical relative abundance estimates of small centrarchids and yellow perch were related to walleye recruitment history. Eleven northern Wisconsin lakes were sampled during 2019 and 2020 using mini-fyke nets, cloverleaf traps, standard boat electrofishing, and electrofishing from a boat using a hand-held probe. Current and historical small centrarchid abundance was not related to walleye recruitment history (except for smallmouth bass) and this suggests that sustained walleye recruitment can occur in lakes with relatively high abundance of small centrarchids. Relative abundance of juvenile yellow perch was related to probability of walleye recruitment success during 2000-2006.

Effects of centrarchid removal on percid populations

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

The Center for Limnology at UW-Madison, the Wisconsin Cooperative Fishery Research Unit at UW-Stevens Point, and the WDNR completed their fourth year (2018-2020) of experimental removal of centrarchids in McDermott Lake, WI (33 ha), to assess the effects of removal on walleye recruitment and yellow perch population dynamics and demographics, among other things. The fish community has been closely monitored since 2017 when the project was initiated and will continue in 2021. More than >280,000 centrarchids have been removed since 2018. There has been no evidence of natural walleye recruitment throughout the study period, but yellow perch have appeared to increase. Removals will continue in 2022 and we will continue to monitor the lake into the future.

Movements and Spawning Locations of Walleye in Green Bay

Submitted by Daniel Isermann, USGS-Wisconsin Cooperative Fishery Unit, University of Wisconsin-Stevens Point, Contact: dan.isermann@uwsp.edu

The transmitters we implanted in 339 walleyes in Green Bay during 2017 and 2018 have largely expired and we have new post-doc on board, Dr. Lisa Izzo who is now analyzing these data which represents millions of detections. Preliminary results indicate that not all walleyes in southern Green Bay are tributary spawners and that fish that spawn south of Chambers Island almost always stay south of the island whereas some fish spawning in northern Green Bay do move south of Chambers Island. Additionally, use of tributaries was not entirely relegated to spawning, especially in the Fox River. We expect to have final results in the next 2-3 months.

17. **University of Wisconsin-Madison, Center for Limnology**

- **Application of eDNA as a tool for assessing fish population abundance** – submitted by Michael Spear

Spear MJ, Embke HS, Krysan PJ, Vander Zanden MJ. Application of eDNA as a tool for assessing fish population abundance. Environmental DNA. 2021;3:83–91. https://doi.org/10.1002/edn3.94

Summary:

Estimating the abundance of fish is critical for the management of fisheries which relies on accurate assessment of population status to maximize yield without overharvesting populations. Monitoring population status is particularly challenging for inland fisheries, such as Wisconsin walleye, in which populations are distributed among many individual waterbodies. Environmental DNA (eDNA) may offer a cost-effective way to rapidly estimate populations across a large number of systems if eDNA quantity correlates with the abundance of its source organisms. Here, we test the ability of quantities of eDNA recovered from surface water to estimate the abundance of walleye (Sander vitreus), a culturally and economically important sportfish, in lakes in northern Wisconsin. We demonstrate a significant, positive relationship between traditional estimates of adult walleye populations (both number of individuals and biomass) and eDNA concentration (R2 = .81; n = 22). From this established relationship, individual walleye populations may be efficiently assigned categorical fishery management strategies based on surface water samples alone. Our results highlight the utility of eDNA as a population monitoring tool that can help guide and inform inland fisheries management.

- **Effects of centrarchid removal on population dynamics and demographics**

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

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