North Central Division of the American Fisheries Society

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

2:30-4:30 PM, Sunday, January 26, 2020
Wyndham Hotel – Vista 1 Room
Springfield, Illinois

WTC Chair: Mark Ermer, Mark.Ermer@state.sd.us
WTC Chair elect: Lawrence Eslinger, lawrence.eslinger@wisconsin.gov
WTC Immediate past-chair: Dale Logsdon, dlafs2012@gmail.com
WTC Secretary: Dave Seibel, david.seibel@wisconsin.gov
ETC Chair: Keith Koupal, Keith.Koupal@nebraska.gov
CTC Chair: BJ Schall, Benjamin.Schall@state.sd.us

Meeting Minutes

1. **Call to order at 2:35 pm by Mark Ermer**
   - Introductions. Attendance sheet was not passed around, but approximately 20-25 attendees with representation from all committees. For the first time a business meeting of the WTC was broadcast live on-line. A week before the meeting, members of the WTC email distribution list were notified how they could join the meeting on-line. Two people took advantage of this opportunity: Dale Logsdon and John Bruner.

2. **Agenda additions and approval**
   - No additions

3. **Approve minutes from 2019 winter meeting and 2019 summer meeting**
   - Motion to approve both the winter and summer meeting minutes by Lawrence Eslinger, second by Dan Isermann

4. **WTC Treasurer's report presented by Mark Ermer**
   - Mark E. clarified that the $2,500 to the AFS investment portfolio in September was not a true expense since it was dollars moved into our investment portfolio. Receipt of the deposit was confirmed by Drew Holloway (NCD AFS Secretary-Treasurer).

   - Table of expenses, deposits, and balances for calendar year. No further discussion. Motion to approve by Jeff Stein, second by Joe Parkos.

5. **AFS news from Rebecca Krogman (AFS Multistate Conservation Grants Advisory Panel)**
   - AFS has obtained several multi-state grants which are relevant to the technical committees.

   <u>1 - Grey Literature Clearinghouse</u>
   - What it is
     - An online repository for all fisheries white papers/grey lit that may be useful for us to exchange and find
     - Built in association with the fisheries.org website, so your login should be connected

- Search papers by title, author, geography, species, other keywords, and download the PDF version
- Submit papers for long-term archival and access through a paid moderator to ensure records are appropriate and complete

- Why it was created
  - We all have a need for better access to grey literature, and often cannot find anything beyond the few hard copy reports printed in our own offices (and even those are in filing cabinets and boxes that aren't organized). This system is meant to make all that grey literature available to fisheries professionals through an easy, long-term online system hosted by the American Fisheries Society.
  - Because it is now hosted by AFS, it will not go away on a government's whim.
- Status
  - The test database has been built and reviewed once, followed by extensive testing and refinement. The second demo is expected within the next few weeks.
  - The complete project is expected in summer 2020.
- How the technical committee may be affected
  - The technical committees have always been the epicenter of sharing information among chapters. This clearinghouse will facilitate long-term storage of any reports we wish to share with each other in an easier way.
  - We can provide feedback on whether features or projects like the grey literature clearinghouse are useful to us as AFS members. If it's not a service to AFS members, then we should be sending that message to the AFS leadership.

<u>2-Fisheries Research Tracking and Information Exchange Tool</u>

- What it is
  - An online "active research" interface built ON TOP of the grey literature clearinghouse infrastructure. I think that means that if we login with our AFS account, we can obtain appropriate permissions to utilize any tools which are built into it.
  - A repository of current and planned research projects, helping to create communities of shared interest around topics where collaboration will enhance and improve the research projects
- Why it was created
  - There is a need for more timely awareness of ongoing and planned research to avoid inefficiencies, duplication, and loss of collaborative opportunities.
  - To enhance communication across borders regarding ongoing research and shared interests
  - Essentially, the same reason we have TCs
- Status
  - Just initiated and brainstorming
- How the TC may be affected
  - I suggested that this tool should become the online home for all Technical Committees, because they are already tasked with this exact purpose and have a need for better tools to facilitate their operations.
  - I suggested building the tools to have numerous functions each TC could use: 1) independent login access to control our own sections/committee pages, 2) email listserv support through a standard mechanism, 3) oversight of our own forum, 4) oversight of our own surveys/forms, 5) ability to upload files like photos and reports to a cloud storage of TC business, and 6) oversight and ability to upload grey literature.
  - If you think this is useful or not, or think additional features should be included to make the tool useful to us as AFS members, please let me know!

3-Research Agenda Project

- What it is
  - An effort to identify common research themes of importance to the fisheries community and to develop "best practices" for assembling future research priorities across states
- Why it was created
  - To establish the foundation for a system promoting coordination among agencies on common research priorities, thereby leveraging limited research funding to a greater degree
- Status
  - Just initiated and brainstorming
- How the TC may be affected
  - They will be hosting several workshops at major meetings to get feedback/input, including AFS Baltimore 2021, Midwest in St. Paul, WD AFS in Ogden 2021, and SEAFWA or SDAFS in 2020/21.
  - They plan to invite a diverse spectrum of state, federal, and university fisheries research leaders and administrators/managers. If you or someone you know would be a good contributor to this discussion, please share this upcoming opportunity with them. Also pass that name along to Rebecca so she can ensure the person is included.

6. AFS news from Scott Bromar (AFS President)

- Scott mentioned that as a follow-up to the multi-state grant update that Rebecca gave, AFS also acquired a grant to work on an update (i.e. 2nd edition) of the AFS "Standard Methods…" publication.

- Scott plugged the 150th National AFS meeting upcoming this summer in Columbus, Ohio, and encouraged members to consider submitting symposia ideas.

- Scott encouraged members to engage in communication and action on climate science, to get the science out (talk to 10 people).
  - AFS Climate Communication Committee has started and published climate science info on the AFS website.

7. Sander travel award

- Ethan Brandt, University of Wisconsin- Stevens Point, accepted the $200 sander travel award, thanking the group for the award. Wisconsin Chapter of AFS will match the award to Ethan.

Ethan Brandt (center) accepts the sander travel award. Also pictured are WTC chair-elect, Lawrence Eslinger, and WTC chair, Mark Ermer.

8. 2020 Summer Meeting: July 20-23, Kemp Natural Resources Station, Woodruff, WI

- Lawrence E. provided a flyer regarding the upcoming 2020 summer meeting. Lawrence identified ideas of the continuing education program associated with the meeting being: 1. Minocqua Chain Walleye Rehabilitation Project – a case study into the biological and sociological aspects of fisheries management. 2. Refining your photography and video production skills for use in fisheries. 3. PowerPoint and presentation basics. He also mentioned the idea of surveying and monitoring physical habitat characteristics influential to fisheries as a possible continuing ed. idea. Final information on the meeting details will be sent out soon.

9. Break-out sessions for CTC, ETC, and WTC- State and Provincial Reports

- No break-out sessions for CTC or ETC. State and provincial reports were not given during the meeting, but they are included at the end of these minutes.

10. Old business WTC

- The WTC is planning to submit a Walleye and Perch symposia for the 2021 Midwest F&W Conference in Minnesota in 2021, with the hope of publishing some of the proceedings of the symposia within a special publication.

- John Bruner submitted the following symposium to the national AFS meeting in Ohio, "Biology, Management, and Culture of Walleye, Sauger, and Yellow Perch: Status and Needs", which was accepted. Within the sign-up details for that symposium is an opportunity to participate in a "Sauger Social" at the meeting.

11. New business WTC

- Mark E. and Lawrence E. will present a proposal/request to the NCD AFS at their upcoming winter business meeting (tomorrow) for $5,000 to assist with publishing efforts of the 2021 Midwest Walleye and Perch symposium. Mark encouraged members to attend the NCD meeting to support the proposal.

Past chair, Mark Ermer, accepts a certificate of appreciation from incoming chair, Lawrence Eslinger.

12. Installment of new WTC chair (Lawrence E.)

- Certificate of appreciation was given to past chair Mark E.
- There were no nominations received for a new chair-elect of WTC; members were encouraged to talk to people that might be interested.

13. Meeting Adjourned at approximately 3:50.

STATE REPORTS

IOWA

2019 Iowa- NCD Walleye Tech Committee Report

Report by Andy Jansen

1) Big Creek Fish Barrier Evaluation

Contact: Ben Dodd, Fisheries Biologist, ben.dodd@dnr.iowa.gov

- Preliminary results indicate that the fish barrier at Big Creek Lake is effective at reducing Walleye & Muskellunge escapement. We are in the process of entering data and planning to install another fish barrier (same design) at Brushy Creek Lake in 2020. We hope to extend our barrier evaluation project to include a pre and post evaluation at Brushy Creek Lake.

2) Fish Culture Research Update

Contact: Alan Johnson—Fisheries Biologist, alan.johnson@dnr.iowa.gov

- Recirculation Aquaculture Systems for Walleye Production From Fertilization to Advanced Fingerlings

Iowa's Dept of Natural Resources cool and warm water production facilities at Rathbun Fish Hatchery (RFH) and Spirit Lake Fish Hatchery (SLFH) use surface water sources to produce fish in single-pass culture systems. Surface water sources may carry viral, bacterial, and protozoan pathogens which can cause fish mortality and are threatened by the spread of aquatic invasive species (AIS), such as Zebra Mussels. Recirculating aquaculture system (RAS) technology offer a solution to these problems by greatly reducing water required for fish production.

Few studies have evaluated RAS technology for Walleye production. Pilot scale RAS have been built at the Rathbun Fish Culture Research Facility (RFCRF) for egg incubation, larviculture (Phase I), and growout (Phases II and III) to evaluate established Walleye production methods in a RAS setting. Dechlorinated municipal water was used to activate fertilization and water hardening of eggs and to fill and maintain water in all RAS.

In 2019 the egg incubation RAS produced 2.8 million fry with 62% survival to hatching. A portion of the fry were stocked into a larviculture RAS (LRAS; 5.6 m^3 culture volume) and reared to 0.6 to 1.5 g size with a 72% survival rate. The LRAS produced 121,555 fingerlings in Phase I and a portion were transferred to the grow-out RAS (GRAS; 32.7 m^3 culture volume) for Phase II. After 22 days in the GRAS, tanks were harvested and fish were size graded and restocked into the same tanks at a lower density for Phase III. The GRAS produced 26,900 fingerlings (8.4 g) at 79% survival in Phase II and 16,582 fish (96 g, 219 mm) at 91% survival were produced in Phase III.

This was the first trial using RAS systems and municipal water for walleye culture from egg fertilization until fall harvest at RFCRF. Only two mild outbreaks of bacterial gill disease were documented and treated throughout any of the culture phases. Columnaris, Ich, and Chilodonella Diseases frequently infect walleye and cause mortality during intensive culture at RFH; however, none of these diseases were observed on walleye reared in RAS during the 2019 trial.

3) Large Impoundments Fisheries Research Update

Contact: Rebecca Krogman—Large Impoundments Research Biologist, Rebecca.krogman@dnr.iowa.gov

- **Evaluation of Walleye Size-at-Stocking in Reservoirs**

This study has been ongoing and should conclude in 2021, when a completion report will be made available. Walleye have been stocked at two sizes (fry and advanced fingerling ~8") for several years in seven locations across Iowa. Stocking was completed in 2018, and this spring 2020 marks the final sampling associated with this project. The relative survival to adulthood (Age-2) of each size will be evaluated and compared across systems.

Expect stocking recommendations based on this study in 2020-2021.

- **Comparison of Walleye Strain Performance in Large Reservoirs**

This new study began in 2019 and is scheduled to end in 2028.

Walleye fisheries are sustained in Iowa's inland waters through stocking, and the fitness of fish stocked may depend on physical and behavioral characteristics unique to genetic strain. Lake-strain Walleye, adapted to lake and reservoir life, and river-strain Walleye, adapted to moving waters, may perform differently in different environmental conditions. This study compares the two strains when stocked into large reservoirs with varying physical and environmental characteristics.

Background

Walleye *Sander vitreus* persist in Iowa lakes and reservoirs primarily through maintenance stocking; little natural reproduction has been documented in most reservoirs although this can be variable (Iowa DNR, unpublished). Thus, low survival of stocked fry and fingerlings to the fishable stock is a substantial barrier to maintaining adequate adult Walleye densities. The Iowa DNR's standard Walleye management goal is to maintain at least 3 adults/acre (Walleye Management Plan 2019). Unfortunately, it is very difficult to achieve this density even with intensive annual stocking due to frequent fry failures, high overwintering mortality, and high escapement, combined with a lack of natural

recruitment to fill in the gaps. Low stocking success despite high-density stocking is common, with no linear relation between stocking density and later catch-per-effort (Li et al. 1996).

Walleye are native to large rivers in Iowa, especially the Mississippi River. Walleye stocking in Iowa has been documented as early as 1880, with reports indicating source fish primarily taken from the Mississippi and Missouri rivers (Iowa DNR Stocking Reports). Additional out-of-state sources have occasionally been used to supplement enhancement efforts, likely resulting in a mixed strain of Walleye from multiple genetic backgrounds. Cultured fish from Spirit Lake were stocked into Rathbun Reservoir in 1969, which became the primary walleye broodstock lake in the state (Paragamian 1977). Although they are likely a mixture of multiple strains (including the Mississippi River-strain), the Iowa DNR commonly refers to these fish as "lake-strain." This mixed strain may be genetically and behaviorally different from the original "Mississippi River-strain" (hereinafter, lake strain and Mississippi River-strain will refer to the strain descriptions provided here). Substantial literature supports the existence of strain-level genetic variation in Walleye (Billington et al. 1992; Billington 1996; Page et al. 2017) and other fish species (Miller et al. 2009; Prichard et al. 2018), as well as consequent behavioral and physical differences between strains (Terre et al. 1995; Jennings et al. 1996; Miller et al. 2009; Parker et al. 2009). In Iowa rivers, three strains (lake-strain, Mississippi River-strain, and an Osage River Missouri strain) were stocked and monitored from 1986-1989, revealing that lake-strain contributed little to the fishery; however these findings were confounded with size-at-stocking (Paragamian and Kingery 1992). Additional research determined that Mississippi River-strain vastly outperformed lake-strain in terms of contribution to the fishery, producing between 1.8 and 8.6 times more fish (Gelwicks 2001). Stocking fish that may have lacked appropriate heritable traits conducive to survival resulted in higher mortality of stocked fish, rendering any stocking program of the incorrect strain ineffective.

Walleye are the most popular targeted sport fish species in Iowa, according to the 2018 Angler Survey (Responsive Management 2019). Approximately 24% of anglers prefer Walleye. This important fishery is supported by a large hatchery culture and stocking program, which annually produces 160 million fry and over 405,000 fingerlings for lake and reservoir stocking at a cost of $442,306.28 (2018 Culture Report). Stocking is popular among anglers, and requests for stocking by fisheries managers continue to increase each year, expanding existing stocking programs with more and bigger fish and extending to smaller waterbodies which are not considered eligible for stocking under the current Walleye Management Plan. Strategic stocking, accounting for strain-specific and general requirements of Walleye for optimal survival, is necessary for an effective and cost-efficient program. To better serve anglers, the Iowa DNR prioritized the assessment of Mississippi River-strain Walleye performance in reservoirs, with the objective of establishing improved stocking recommendations for Walleye. Without this investigation, lake-strain-only stocking will continue, entailing substantial culture investment, and may not achieve its full potential in providing outstanding Walleye fishing opportunities across Iowa.

Expected Results and Benefits

If Walleye strains differ in long-term survival and recruitment to the fishable stock, then strain choice becomes an important factor in stocking requests for lakes and reservoirs. Guidance regarding optimal strain choice will be developed, with clear indication of when specific stocking choices are untenable. This guidance will be provided in the form of formal stocking recommendations designed to maximize the effectiveness of Walleye stocking in inland waterbodies. This reduces hatchery production costs while maximizing the availability of Walleye fishing opportunities across Iowa, providing the most preferred fishing opportunity to as many people as possible for a little cost as possible.

- **Fish Movement and Mortality Associated with Dam Passage**

This new study began in 2019 and is scheduled to end in 2026. A graduate student, J. Kylee Ecker, is leading the first part of this study. Specifically, she plans to work with Walleye, as well as a handful of other species. Also note this project is in collaboration with the Large Rivers Research Team (Hupfeld).

Dams act as major barriers to fish movement, and passage downstream can often lead to death. Hydropower facilities can add to this problem because fish must pass through power-producing turbines. This study seeks to quantify sportfish movement through large dams and determine effects of hydropower facilities on reservoir fisheries.

Background

Dams act as substantial barriers to fish movement in both directions, and most dams in Iowa have no fish passage infrastructure (e.g., fish ladders) to facilitate upstream movement. Large dams impounding major rivers, such as Red Rock Dam and Saylorville Dam, prevent upstream movement with a sheer drop of up to forty feet. Shorter dams, like Ottumwa Hydropower Dam, may allow passage upstream during high flows. The true extent of fish movement upstream and downstream by sport fishes is unknown, and the potential for mortality caused by spillway passage or passage through hydropower facilities is unknown. Downstream passage may be somewhat limited by the reservoir itself, which provides drastically different habitat than the riverine portions of the Des Moines River. Fluvial species are generally unlikely to emigrate simply because they are unlikely to pass through the reservoir to get to the dam (Clark et al. 2007). Work in South Dakota indicated that Walleye tended to stay within a single reservoir, rather than going downstream (Riis et al. 1993). Likewise, Channel Catfish tended to move little, at most 50 km, and stayed in the same pool of the Des Moines River impoundments (Harrison 1953; Muncy 1958). Bigmouth Buffalo stayed within a 4 mile study area in Coralville Reservoir with no notable downstream movement (Mitzner 1971). Nonetheless, one-way downstream movement related to discharge can be an important component of population connectivity in large impounded rivers as shown on the Missouri River (Pracheil et al. 2014). In addition, Sauger have been shown to move over 200 km downstream when seeking suitable spawning habitat (Pegg et al. 1997) and readily emigrated from a large Ohio reservoir into the tailwater (Spoelstra et al. 2008), and Channel Catfish in open river systems move up to 100km (Welker 1967). In Rathbun Reservoir, Walleye escapement is extremely probable for any fish that encounters the spillway (M. Flammang, personal communication), exceeding 13% annually (Weber et al. 2013). Escapement was most strongly related to discharge. Escapement of Walleye and Muskellunge from Brushy Creek Lake exceeded 15 and 40% per annum, respectively, and peaked in late spring and early summer in association with precipitation events (R. Weber, personal communication). Hybrid Striped Bass juveniles escaped during winter through a fish barrier at Big Creek Lake, Iowa, at a rate over 15% (R. Weber, personal communication) and have been shown to emigrate at high rates from larger reservoirs (Kuklinski 2013).

A new hydropower facility will be functioning soon at Red Rock Dam. One of the substantial changes resulting from this is the deviation of flow into large turbines for power production. Fish movement out of Red Rock Reservoir may then occur both through the spillway or the turbine. Turbine passage has been shown to cause physical damage and disorientation of fish passing through, resulting in increased mortality (Kent et al. 1998), and is related to turbine design, water velocity, and fish length (Amaral et al. 2015). Overall turbine passage survival may be high across species (nearly 80%: Bell and Kynard 1985; over 90%: Amaral et al. 2015); however fish of greater concern are typically larger in size and are at higher risk of physical entrainment (Amaral et al. 2015). A study of lowhead dams in Michigan showed that the most frequent losses downstream were centrarchids (dominated by Rock Bass, Black Crappie, Bluegill, and Smallmouth Bass) and catfish (dominated by bullheads) (Navarro and McCauley 1993). Sportfish species suffered almost 20% acute mortality after passage (Navarro et al. 1996). Similar dominance by *Lepomis* panfishes was found in South Carolina reservoirs, with escapement being most likely during surface spillway discharge (Paller et al. 2006). Escapement was less likely during hypolimnetic releases through a cooling outlet. The time period of greatest risk may be spring for younger fish and autumn and winter for adult fish (Coutant and Whitney 2000; Martins et al. 2013).

The effects of the hydropower installation at Red Rock Dam are largely unknown, but could be important in not only managing the sport fishery at Lake Red Rock but in guiding future hydropower projects in Iowa. There is a possibility of future hydropower installations on other existing dams such as Saylorville Dam, as well as the possibility of future dam removals such as at Ottumwa Dam. Failure to conduct this research will lead to the continued challenge of inappropriate or inadequate mitigation actions, as development of alternative energy will likely continue whether biology is considered or not. Investigation of these questions will inform future mitigation and development plans to minimize negative effects on the sport fishery and maximize river connectivity.

Expected Results and Benefits

The information garnered from this study will help fisheries managers determine the current and potential impacts on their reservoir sport fisheries of hydropower development and the dams in general. Escapement is a common and challenging issue faced by most fisheries managers, and a better understanding of conditions associated with high escapement can help them take mitigative actions (e.g., recovering fish in the tailwater at targeted times of the year) or adjust their fishery development tactics (e.g., stocking plans). Most importantly, the Department as a whole will be able to provide more scientific input regarding future hydropower development plans proposed in the future.

4) Natural Lakes Fisheries Research Update

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

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

NEED

Walleye have been stocked by the Iowa DNR into almost every natural lake in Iowa over the past 50 years; however, only a few of these natural lakes consistently sustain high quality Walleye fisheries. Iowa's natural lakes region is a popular destination for tourists, recreational boaters, and anglers, particularly in the spring and summer months (Jeon et al. 2016; Duda et al. 2019). People from across Iowa as well as other states are drawn to the region to pursue Walleye angling opportunities. Besides being important Walleye fisheries, these lakes are the main source of broodstock Walleye for the Spirit Lake Fish Hatchery.

Due to the popularity of Walleye by anglers and their importance as a broodstock source, restrictive harvest regulations were necessary to conserve Walleye populations (Larscheid and Hawkins 2006). In January 2007, a protected slot limit of 17-22 inches was implemented on Spirit Lake, the Okoboji lakes, and Storm Lake. This slot was designed to increase densities of broodstock fish and allow harvest of smaller, slow-growing Walleye. A 14-inch minimum length limit was maintained on Clear Lake. A daily 3-fish bag limit was retained on all these lakes, but only one Walleye over 22 inches could be harvested.

Recent research has demonstrated that an adaptive management approach is necessary on these dynamic fisheries. Many factors, including prey population levels, ever changing hatchery products, and recently introduced zebra mussels will likely affect these fisheries. Adaptive management necessitates a strong research component to continuously evaluate management strategies so that our broodstock Walleye population densities are maximized. Annual assessments combined with adaptive management will allow managers to adjust stocking rates as needed to properly manage Walleye in multi-species fisheries, and to have the information necessary to discuss the Walleye program with constituents.

APPROACH

Walleye were collected with gill nets (6 × 320 ft; 2.5-in bar mesh) from Spirit Lake, Okoboji Lakes, Clear Lake, and Storm Lake during late March to early April (i.e., Walleye spawning period). Fish were transported back to egg taking facilities near each lake where eggs and milt were stripped. Fish were held in raceways after fish culturists completed their work. Prior to release, Walleye were measured to the nearest tenth of an inch and the first two dorsal spines were removed for age estimation (annually for Spirit and Okoboji Lakes, every third year for Clear and Storm lakes). Dorsal spines were placed in numbered coin envelopes and allowed to dry. Walleye ages were estimated by sanding the basal end of the spine flat using 1000 grit sandpaper and viewing the spine under a compound microscope aided with a fiber optic light source (Logsdon 2007). All Walleye (≥17 inches in length) captured were examined for a previous tag or mark. All unmarked Walleye collected from Spirit Lake or the Okoboji Lakes were tagged by inserting a 12-mm Passive Integrated Transponder tag (PIT tag) in the isthmus (Vandergoot et al. 2012). Walleye collected from Clear and Storm lakes were batch marked by injecting visual implant elastomer on the underside of the lower mandible. Visual implant elastomer color and side of injection were alternated so that year-specific marks were available. Adult Walleye densities were calculated with the

Jolly-Seber model (an open population model; Seber 1982), and confidence limits around these estimates were estimated from the method of Manly (1984).

FINDINGS

Walleye densities ranged from 473 to 9,598 fish in 2018 (**Table 1**). In most years, broodstock densities in these lakes were below management objectives (2.0 adult fish per acre); however, since the establishment of the protected slot limit, these objectives have been more consistently met in Spirit Lake and Storm Lake (**Figure 1**). Walleye broodstock density objectives have declined in Clear Lake since 2005 and have not exceeded 1.0 fish/acre since 2009. In the Okoboji lakes, these objectives have never been met, but population densities have doubled since the establishment of the protected slot limit (Figure 1). Recruitment, catchability, and annual survival varied considerably in all lakes from 1990 to 2018 (**Table 1**). Dorsal spines were collected from 104 male and 150 female Walleye from East Okoboji Lake and based off these samples, consistent recruitment and moderate growth rates were observed (Figure 2).

Table 1. Annual catchability (p), survival (S), abundance (N), and recruitment (B) of broodstock Walleyes (≥ 17 in TL) in Spirit Lake, Okoboji Lakes, Clear Lake, and Storm Lake. Netting was not conducted in Spirit Lake in 2018.

Year	Spirit Lake				Okoboji Lakes				Clear Lake				Storm Lake			
	p	S	N	B	p	S	N	B	p	S	N	B	p	S	N	B
1990		91.2%				60.8%										
1991	0.15	45.4%	2,438	2,419	0.20	62.9%	2,519	799								
1992	0.22	77.2%	3,526	861	0.20	59.3%	2,384	614								
1993	0.11	84.8%	3,581	1,726	0.17	73.2%	2,028	1,684								
1994	0.18	49.5%	4,764	263	0.21	79.1%	3,168	1,224								
1995	0.19	61.1%	2,622	1,682	0.18	71.2%	3,729	2,227		50.4%				136.2%		
1996	0.20	96.6%	3,283	5,178	0.16	57.4%	4,880	147	0.12	48.4%	5,079	0	0.03	5.8%		0
1997	0.12	47.4%	8,349	0	0.15	53.3%	2,946	822	0.32	66.1%	2,041	203	0.18	59.7%	3,870	7,042
1998	0.17	76.5%	3,853	4,266	0.27	72.6%	2,393	1,598	0.31	65.3%	1,552	506	0.11	57.3%	9,352	9,555
1999	0.18	82.2%	7,214	-200	0.16	76.1%	3,334	1,988	0.34	53.1%	1,519	1,216	0.08	46.3%	14,913	8,408
2000	0.11	47.2%	5,728	1,939	0.12	61.9%	4,525	483	0.32	100.0%	2,023	6,894	0.06	21.8%	15,307	2,076
2001	0.10	62.1%	4,641	4,524	0.09	51.0%	3,285	4,580	0.17	60.0%	8,997	272	0.19	24.0%	5,381	2,654
2002	0.13	77.9%	7,406	269	0.07	55.7%	6,254	0	0.26	47.0%	5,668	966	0.31		3,942	
2003	0.09	70.3%	6,036	0	10.10	59.6%	1,641	758	0.17	75.7%	3,627	3,036				
2004	0.07	45.0%	4,013	295	0.13	48.9%	1,737	295	0.21	76.3%	5,784	5,059				
2005	0.18	45.1%	2,099	184	0.12	46.8%	1,145	467	0.10	99.4%	9,470	2,377		60.0%		
2006	0.13	58.6%	1,129	616	0.26	100.0%	1,003	770	0.07	81.8%	11,793	0	0.55	67.3%	3,603	1,638
2007	0.21	100.0%	1,278	10,386	0.12	51.8%	1,874	1,951	0.07	93.7%	5,584	1,186	0.28	63.5%	4,064	1,592
2008	0.10	53.6%	11,669	8,156	0.13	60.8%	2,922	913	0.14	73.0%	6,416	1,349	0.29	55.6%	4,171	3,480
2009	0.16	54.8%	14,412	4,109	0.10	70.0%	2,689	669	0.17	27.8%	6,030	0	0.30	69.0%	5,799	1,318
2010	0.18	36.1%	12,003	,7529	0.07	41.5%	2,551	2,175	0.08	40.2%	1,569	2,675	0.18	63.6%	5,321	3,709
2011	0.19	47.2%	11,857	5,725	0.20	68.5%	3,234	2,551	0.08	63.9%	3,305	0	0.20	15.8%	7,095	2,076
2012	0.12	39.0%	11,318	4,251	0.13	41.4%	4,765	1,339	0.08	21.5%	1,348	224				
2013	0.14	58.6%	8,663	5,870	0.26	61.5%	3,311	5,710	0.21	84.7%	514	1,530	0.10	41.4%	3,198	2,370
2014	0.14	49.0%	10,943	4,551	0.22	66.8%	7,745	977	0.26	89.3%	1,965	1,517	0.25	62.2%	3,694	3,535
2015	0.22	65.3%	9,917	1,513	0.21	52.4%	6,154	859	0.22	24.5%	3,272	455	0.44	99.1%	5,832	5,931
2016	0.17		7,991		0.23	70.8%	4,082	1,004	0.32	66.4%	1,256	382	0.22	55.4%	11,713	3,097
2017		41.1%		1,366	0.25	51.8%	3,892	7,583	0.22	26.6%	1,216	149	0.18	51.1%	9,590	3,015
2018	0.37		4,651		0.12		9,598		0.41		473		0.21		7,911	

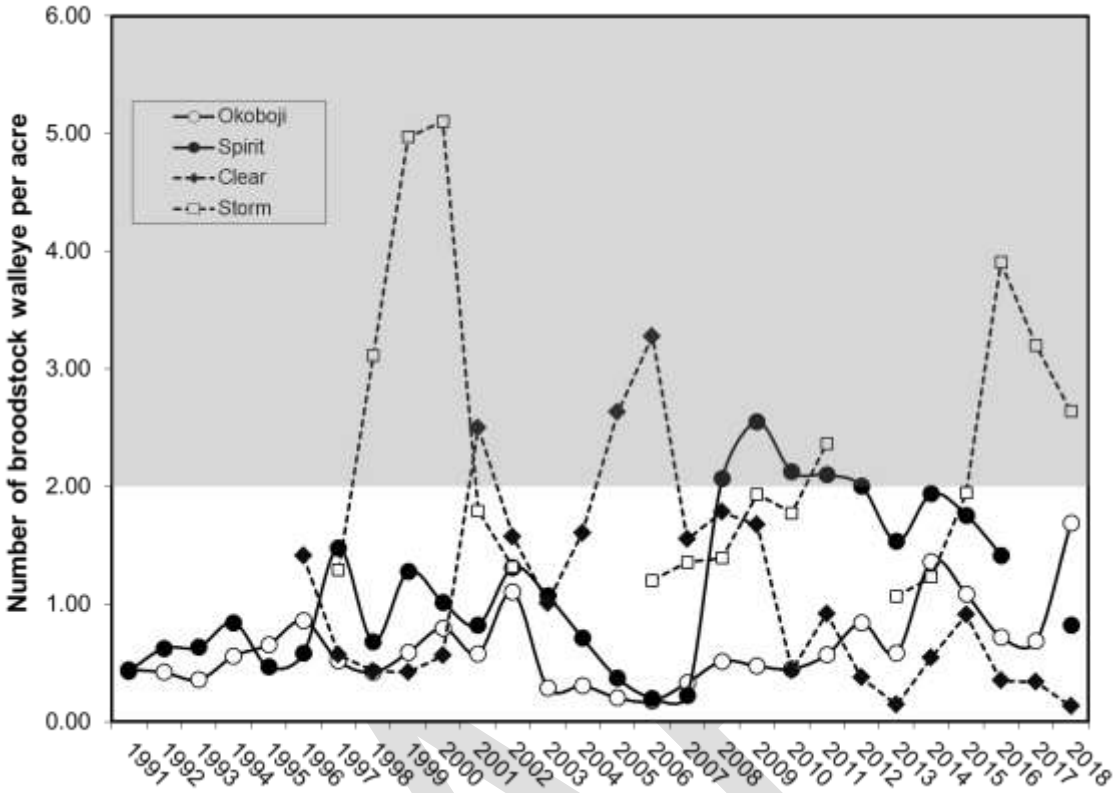


Figure 1. Number of broodstock Walleye (≥ 17 in TL) per acre in Spirit Lake, Okoboji lakes, Clear Lake, and Storm Lake (1991-2018) based on the Jolly-Seber open population model. A management objective of ≥ 2.0 Walleye per acre is represented in grey.

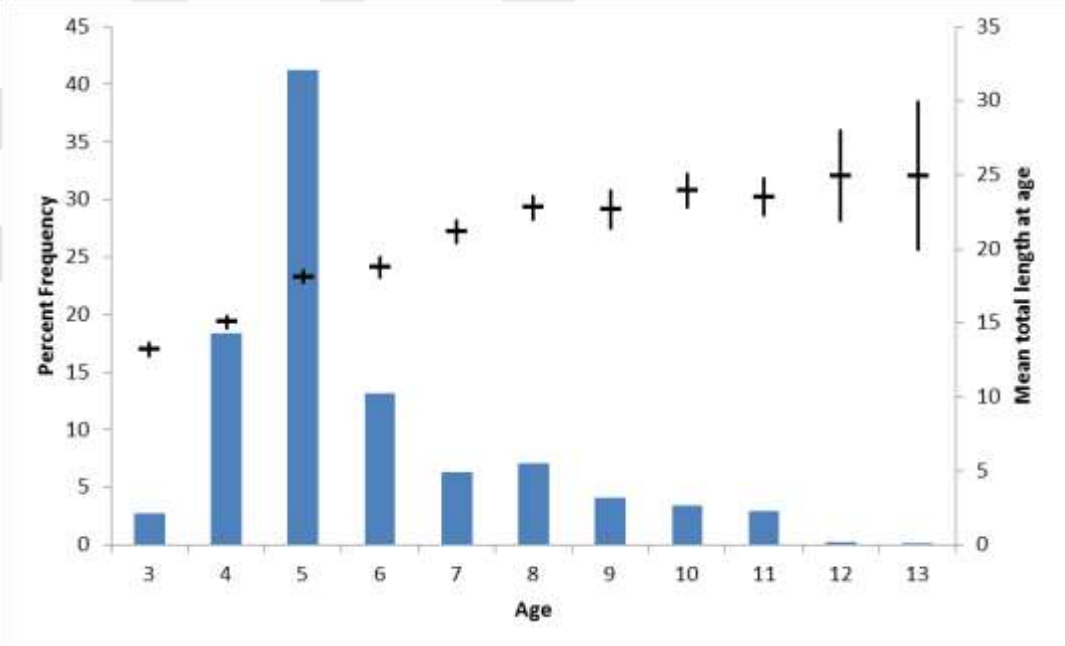


Figure 2. Age distribution (percent frequency) and mean total length at age (95% confidence intervals) for Walleye collected from East Okoboji, 2018.

- **Effectiveness of an electric barrier to reduce emigration of Walleye and Muskellunge in Iowa's natural lakes**

  This project will focus on field evaluation of a low-pulse electrical field (installed October 2019, 0.5 volts/in) placed in front (upstream) of the electric fish barrier in attempt to reduce fish loss. We have documented substantial downstream movement of Muskellunge out of the interconnected lake chain. This year, two of the 18 Walleye we captured below the electric fish barrier were tagged during the broodstock operation in 2019. In 2020, we will be analyzing a long-term Walleye tagging database to estimate movement rates among the lakes and emigration to Milford Creek. In addition, we will be field testing the low-pulse electrical field via placing fish in a large net pen spanning the length of the electrical field, including "safe zones", to test the fields efficiency in keeping Walleye and Muskellunge upstream of the electrical barrier.

5) Iowa State University Fisheries Research Update

Contact: Dr. Michael Weber –Associate Professor, mjw@iastate.edu

- Iowa State University is conducting a suite of research projects evaluating Walleye population dynamics in Iowa. Students have found minimal stocking mortality and high post-stocking survival of juvenile Walleye stocked in fall. However, we have observed that predation may be an important source of mortality for even large Walleye until they surpass ~200 mm. Fall stocked Walleye disperse limited distances from stocking locations but quickly adapt behaviors comparable to wild fish. As adults, we have found Walleye can experience high reservoir escapement rates that can be comparable to harvest and natural mortality in many situations. Escapement typically occurs in spring and increases during high water periods. We also have evidence indicating that adult Walleye can spend a large amount of time near reservoir outlet structures, but few of these fish may actually escape, even during high release events.

Ball-Grausgruber, EE, and MJ Weber. In revision. Bigger is better! Evidence of size-selective predation on age-0 Walleye *Sander vitreus*. North American Journal of Fisheries Management.

Ball-Grausgruber, EE, KJ Goode, and MJ Weber. In press. Effects of transport duration and water quality parameters on age-0 Walleye *Sander vitreus* stress and survival. North American Journal of Aquaculture.

Ball, EE, and MJ Weber. 2018. Biometric relationships between age-0 Walleye *Sander vitreus* total length and external morphometric features. Journal of Applied Ichthyology 34: 1277-1284.

Weber MJ, RE Weber, EE Ball, and JR Meerbeek. In press. Using radio telemetry to evaluate post-stocking survival and behavior large fingerling Walleye in three Iowa, USA lakes. North American Journal of Fisheries Management.

Weber, MJ, and M Flammang. 2019. Relative effects of mortality versus emigration for regulating a reservoir Walleye population. Transactions of the American Fisheries Society 148: 123-133.

ILLINOIS

Illinois Update to the NCD Walleye Technical Committee – January 2020

IL WTC Report, January 2020, submitted by Jason DeBoer INHS

Sarah King, Sportfish Ecology Lab, Illinois Natural History Survey

We aim to compare and contrast age demographic data for walleye, sauger, and saugeye in central IL reservoirs (specifically, Lake Decatur, Weldon Springs Lake, Clinton Lake, Lake Shelbyville, Lake Bloomington, Dawson Lake, and Evergreen Lake). To date, we've collected data on 1014 individuals (16 sauger, 275 walleye, and 723 hybrids) and aged 786 fish (13 sauger, 128 walleye, 645 hybrids) using otoliths and/or the 2nd dorsal fin ray. Preliminary growth analyses of saugeye from Evergreen and Dawson Lake were constructed and are presented at the poster session at the conference. Data collection for this project will continue throughout 2020.

Jeremiah Haas, Exelon

Just our normal stuff up here. We were able to do some monitoring but the (MS) river was less than ideal this year. I won't have the reports finalized for a few weeks, but YOY sauger numbers were high, YOY walleyes low, but again, the high water likely had more impact on the numbers than the true populations.

Hatchery walleye egg hatch was good, but had a terrible production year in our spray canal and looking at a new, completely contained, hatching system similar to the Rathbun (IA) State Hatchery uses. Super excited and asking for money currently.

No state record sized fish caught this year in Pool 14 (most disappointing), but we learned a ton about conducting spring walleye collections during significant river flooding. Catching fish was not too difficult.

On a side note, I saw two while shocking that I couldn't get to that could have been over 15 lbs, just too slow in my old age. There are 32"+ fish out there.

Seth Love, Illinois DNR

Saugeye are slated to be stocked into a public co-op lake (Lake Chaminwood, Will County Forest Preserve District) on an annual basis (this is the first year).

Walleye are annually stocked into Heidecke and Whalon (Will County Forest Preserve District) Lakes. Monster Lake has been receiving Kankakee River strain Walleye in an effort to create another Kankakee River strain broodstock source in-case conditions do not permit Walleye egg-take on the Kankakee River.

Nerissa McClelland, Illinois DNR

Upper Illinois River sauger stocking
7,563,000 fry <1"
346,236 1.3" - 1.6"

Tristan Widloe, Illinois DNR

We have been stocking Walleye in the Fox and Kankakee Rivers since 1998 and 2000, respectively. We also started a Sauger stocking program on the Des Plaines River in 2001. All of which have been pretty successful based on electrofishing surveys and angler reports (no creel studies).

We have the most data on the Kankakee River - prior to stocking, catch rates averaged 1 fish/hr. Since then the catch rates have averaged 30/hr during targeted sampling. The stocked fingerlings were marked with oxytetracyline for 10 years and Walleye of all sizes were then harvested for otolith analysis. Based on that study, ~70% of the Walleye were of hatchery origin. Broodstock have always been obtained from native Kankakee River Walleye. We release, on average, 90,000 2" fingerlings into the Kankakee and Iroquois Rivers. In 2019, the average length of broodstock collected from the Kankakee was 19".

Prior to stocking, Sauger did not occur in the upper Des Plaines River (upstream of Brandon Road). They were endemic to the Illinois River system prior to dams and poor water quality. Broodstock for this program are obtained from the Illinois River. Stockings average ~20,000 2" fingerlings per year. Average electrofishing catch rates are 7 fish/hr. However, at prime habitat locations catch rates were as high as 47 fish/hr, with anglers reporting good catches as well. Sauger move throughout the system and many appear to over-winter in the deep tailwaters below the Lockport Lock.

In the Fox River, an average of 35,000 2" fingerlings are stocked each year in the area from upstream of the Yorkville Dam to Silver Springs State Park in Plano. Catch rates are lower in the Fox River with an average of 5 fish/hr; though 79 Walleye were collected below the Montgomery Dam in the fall of 2014, including many YOY. Furthermore, data collected by a consulting firm that conducts sampling each year on a 10 mile stretch of the Fox River, much of which lies within the stocking area, had catch rates of 15 Walleye/hr in both 2017 and 2018.

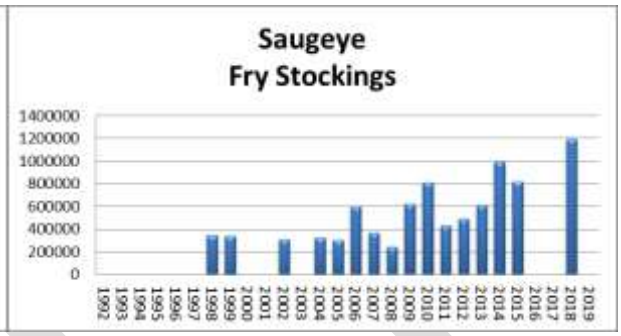
(The target CPUE range for Walleye in Illinois is 15-20/hr.)

Mike Garthaus, Illinois DNR
During the survey of Evergreen Lake, 10 frame nets (4x6 frames; 1.5" mesh) were run for two days to collect saugeye. Frame nets were first utilized in 2002 to assess these fisheries. One of the frame nets collapsed during the survey so only 19 net-nights of effort is being used.

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

Saugeye

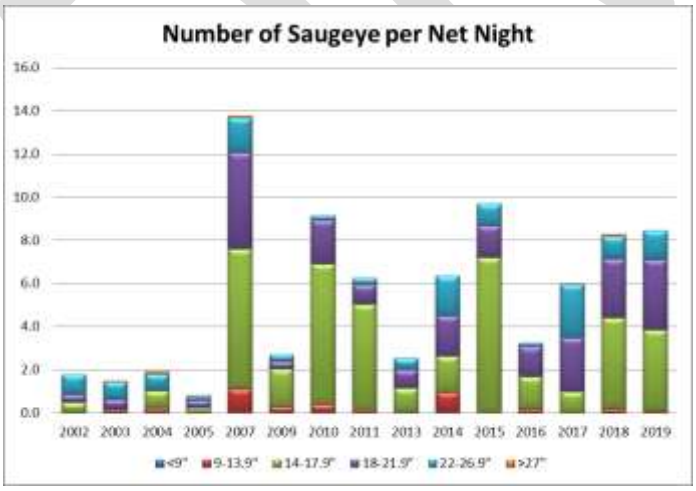
Saugeye were first stocked into the lake in 1992 as part of a study for the North Central Division of the American Fisheries Society. The study was planned for five years, making 1996 the last year. Saugeye have been stocked every year since 1992 and has resulted in a very good fishery.



Density

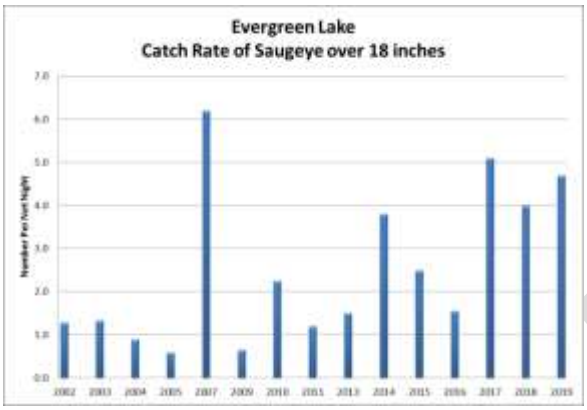
Since the nets have 1.5" mesh, the nets fail to collect smaller saugeye, but the nets catch a larger number of big saugeye than electrofishing. Netting surveys are a poor indication of young year classes for saugeye, but are a good indication of legal-sized fish. No saugeye have been collected less than 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 2017, the catch rate increased to 6 per net night and in 2018 the catch rate increased to 8.3 per net-night. In 2019, the catch rate changed very little and was 8.5 per net-night. The average catch rate since 2002 is 5.5 saugeye per net-night. The walleye management plan has a catch rate objective of 2.5 walleye per net-night.



Size Structure

Of the saugeye collected over 9 inches, 99% were longer than 14 inches and 55% 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. Size structure has improved since the regulation change in 2015.



Condition

Condition, based from relative weight values, was adequate for all sizes and the average relative weight was 100.

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 Masters Walleye Circuit (MWC) tournament was held March 22-23 at the Spring Valley Boat Club, Spring Valley, Illinois. A total of 77 teams participated in the MWC and the water temperature was 44 °F. The river level was normal. During the two day tournament a total of 495 fish were caught by the anglers. At the weigh-in sauger were separated by sex and the fish were transported to the hatchery in two 1 ton hauling trucks. A total of 228 females and 160 males were taken to the hatchery, the remaining 107 fish (89 sauger and 18 walleye) were returned to the Illinois River.

The Battle on the River tournament (BOR) was held on March 24 at Barto Landing, Spring Valley, Illinois. The original tournament date was March 17. However, it was rescheduled due to high river levels. A total of 26 teams participated in the BOR and the water temperature was 44°F. A total of 99 fish were weighed in. A total of 29 female sauger and 30 male sauger were taken to the hatchery and the remaining fish (36 sauger and 4 walleye) were returned to the river.

A total of 14.8 million eggs were taken from fish collected at all the tournaments (186 females) and 9.3 million fry hatched, resulting in a 63.2% hatch rate (Table 3). The average weight of the female sauger was 2.1 lb (1.1-3.6 lb). 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 7.5 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 (3-5) were stocked with 4-7 day old fry on April 16. A total of 600,000/pond (240,000/acre) were stocked. The ponds were finished filling to approximately 1/3 full 10 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. A total of 633,820 fingerlings were produced for stocking in state waters, including 346,366 in the Illinois River, 204,402 in Carlyle Lake, and 28,187 in DesPlaines River. The fingerlings were cultured for an average of 49 d (38-59 d), averaged 1.6 inches (1.2-1.8 inches) and weighed 1,187 fish/lb (890-1,980 fish/lb) at harvest. A total of 436.5 lb of sauger fingerlings were produced (58.2 lb/acre). Fish production was above normal, averaging 84,509/acre. The 18 year average fish production was 71,167/acre. Survival averaged 35.2% in the ponds.

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.

Broodfish collection on the Kankakee River was performed by Region 2 Streams personnel and was carried out from March 27-29. A total of 20 females were collected from the Kankakee River and 19 spawned from March 27-April 3. The average weight of the females was 3.9 lb (2.3-6.8 lb).

A total of 2.0 million eggs were collected and incubated in seven separate batches. The overall hatch rate was 73.1%. Egg volume averaged 108,000/L with an average of 108,842 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 3-5. Broodfish were held at the Spring Grove Hatchery Park overnight and picked up the next day. A total of 102 walleye females were transported to the hatchery from April 3-5. Twelve of the females spawned upon arrival at the hatchery, five were spent and the remaining females received a 500 IU/lb injection of HCG. The females averaged 4.9 lb (2.2-9.4 lb).

A total of 11.1 million eggs were collected from 80 FCOL walleye females from April 3-April 8. Egg volume was 120,000/L with an average of 138,825 eggs/fish. The eggs hatched in 8-9 d (216-243 T.U.) at a water temperature of 59 °F. A total of 7.1 million eggs eyed up and hatched (64.2% hatch rate). Two batches of eggs taken on April 6 had good eye up but poor hatch rates. These eggs were not counted in the overall hatch rate.

A total of 2.3 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

The 2-6 d old FCOL fry (2.3 million) were stocked into a total of six LaSalle Hatchery ponds (7-10,11,13). The ponds were stocked April 16-17 with a total of 300,000-500,000 fry/pond (150,000-200,000 fry/acre). The ponds were finished filling to 1/3 full an average of 7 d (4-10 d) prior to stocking. The ponds were filled to 2/3 full two weeks after the initial fry stocking.

A total of 1,055,187 fingerlings were produced for stocking various lakes and rivers in Illinois including 250,614 in the FCOL, 214,716 in Clinton Lake, 96,306 in the Kankakee River and 71,575 in the Rock River (Table 8). The fish were cultured for an average of 47 d (35-58 d), the average length was 1.5 inches (1.2-1.8in) at harvest. The fish weighed an average of 1,478 fish/lb (858-1,920 fish/lb). Overall survival averaged 37.7%, with a range from 12.5-63.9% (Table 9). Fish production was slightly above normal, averaging 63,431/acre. The 18 year average fish production was 61,403/acre. A total of 683.0 lb of walleye fingerlings were harvested (41.3 lb/acre).

Walleye x Sauger Hybrids

Eggs from 13 female walleye from the FCOL were used for the production of saugeye in 2019. A total of 2.1 million eggs were collected on April 4 and April 9. A total of 1.4 million eggs eyed up, however, the first two batches of those eggs had poor hatch rates and few fry from those batches swam out of the jars. The overall hatch rate was 30.7% and 658,000 viable fry hatched. The eggs were fertilized with extended sauger semen, water hardened and treated with iodine identical to the sauger eggs.

A total of 500,000 fry (4-5 day old) were stocked in two hatchery ponds (14,15) on April 17 and 22. Surplus fry (158,000) were stocked in Lake of the Woods (Table 10). The ponds were finished filling to 1/3 full 10 d prior to the initial stocking. A total of 245,688 fingerlings were raised for stocking in lakes (Table 11). The fingerlings were cultured for an average of 42 d (35-49 d). Average length at harvest was 1.5 inches (1.2-1.7) and average weight was 1,264 fish/lb (845-1,870 fish/lb). Fish production was above normal, averaging 81,896/acre. The 18 year average fish production was 71,182/acre. A total of 178.7 lb of fingerlings were produced (59.6 lb/acre) (Table 12). Overall survival was 49.1%.

Diane Shasteen, Illinois DNR

We received 450,000 fry from LaSalle Hatchery on 18 April 2019, utilized 3,-1 acre ponds for production, harvested ponds on May 30, 31, and June 3rd, stocked 248,037 2" fingerlings in 7 lakes. 55.1% return, one of best returns in recent history.

Lakes included Kinkaid, Banner Marsh, Shelbyville, East Fork, Pyramid Mallard, Pyramid Green Wing, and Lake McMaster.

KANSAS

Kansas Update to the NCD Walleye Technical Committee – January 2020

Submitted by Jeff Koch

Seasonal fishing and natural mortality patterns of Walleye in Glen Elder Reservoir

Scott Waters
Kansas Department of Wildlife, Parks, and Tourism

Reliable mortality estimates are necessary for fisheries managers to make informed science-based regulation decisions. A telemetry based model is being used to determine mortality rates and sources at a 5,000 ha reservoir in northcentral Kansas. Sixty adult walleye (30 males, 30 females) were implanted with ultrasonic transmitters (battery life = 36 mo.) in November 2018 and April 2019, and each fish was tagged with an external reward tag worth $100 to encourage angler reporting. An additional seven fish were also tagged in May 2019 using transmitters returned from anglers. Twelve walleye have been reported harvested and one fish ceased movement in the reservoir indicating natural mortality. All fish harvest occurred between 5 April and 17 July illustrating a strong seasonal harvest pattern. An additional 12 fish are believed to have been entrained due to high releases throughout the year due to several flooding events. Fish exhibited a variety of movement patterns and home range sizes with a general trend of mean depth increasing throughout the summer. Mean depth in mid-May was 10.1 m and decreased to only 3.6 m in mid-August. Additional fish will be tagged in April 2020 to increase the sample size back to 60 walleye and fish will continue to be tracked monthly or bi-monthly with increased effort during the spawn in late March and April.

Sex Reversal of Walleye

Daric Schneidewind

Kansas Department of Wildlife, Parks, and Tourism

In the spring of 2017, the Fish culture section of KDWPT began a multi-year project with a goal of sex reversal of genotypic female walleye *Sander vitreum* to functional phenotypic functional male walleye with gamete producing testes. This project was in conjunction with Iowa Department of Natural Resources and Idaho Fish and Game that would determine sex reversal of genotypic males to phenotypic females with fully functional gamete producing ovaries. Research protocols were written and performed by staff at those facilities. Generally, walleye were reared intensively, pit tagged for identification, and fed either Methyl testosterone or Estradiol hormone laced feed. The specifics of how that was accomplished can be obtained from Meade Fish Hatchery staff. These walleyes were transferred to the Milford Fish Hatchery following the first growing season.

On October 23, 2017 all the Kansas treated, tagged walleye were transported to MILH. The objective of this phase of the project was to grow these fish further to obtain data, verify sexual maturity, and attempt production with potentially sex reversed walleye. Unfortunately, rearing in the outdoor raceways proved to be vulnerable to avian depredation resulting in small sample sizes being reared in most treatment groups. In April of 2018, there were n=57 MT80 group, n=52 MT100, and n=20 control fish remaining at inventory. The 2018 fall inventory showed n=7 MT80, n=8 MT00, and n= 5 controls remaining heading into the over winter period.

March 25, 2019 study fish were sorted and moved inside the facility to obtain the final phenotypic sampling and attempt gamete maturation via Human Chorionic Gonadotropin (HCG) hormone injection. Control fish were tested for rate of HCG hormone required to induce gamete maturation we tested rates of 300, 1000, and 2000 International Units respectively. On 3/29/2019, all study MT100 walleye were

injected with 1ml or 1000 I.U. of HCG. It had previously been determined via the phenotypic sampling that the MT80 group did had only limited potential for sex reversal and therefore that group of fish was not utilized. As fish were handled for injection each fish was manually palpated in the abdominal region of the testes to check for flowing milt. There was no flow observed in any of the MT100 (n=6). Approximately 48 hours post injection fish were checked for flow as previously described and any fish that did not have any observed milt was checked via catheter. The results showed n=4 with light watery flow, n=2 with no flow, of those two fish catheterizations showed one as inconclusive and the other possibly female.

April 2, 2019 fertilization of wild caught female walleye eggs was performed with MT100 group walleye (potentially sex reversed females). A total of n=4 lots of eggs fertilized with MT100 group walleye were produced. Eggs were obtained from wild captured females, the females utilized were also sampled for future genetic testing with a pool of eggs from 2 females utilized for each MT100 functional male. The following summarizes that effort.

LOT #1:

Tag ID = 32458258

2Day egg count = 94,250 (725ml x 130 eggs/ml)

8D Expected fry count = 68,874 viable embryos

Hatch Rate = 73%

LOT #2:

Tag ID = 32451304

2D egg count = 93,240 (740mls x 126 eggs/ml)

8D Expected fry count = 65, 106

Hatch Rate = 69.7%

LOT #3:

Tag ID = 32477954

2D egg count = 92,235 (715mls x 129 eggs/ml)

8D Expected fry count = 62,152

Hatch Rate = 70.6%

LOT #4:

Tag ID = 32484090

2D egg count = 72,360 (540mls x 134 eggs/ml)

8D Expected fry count = 37,989

Hatch Rate = 52.3%

GRANT TOTALS:

EGGS = 352,085

Expected Fry = 234,031

Hatch Rate = 66.5%

Fry were hatched from each lot into individual tanks. Fry were held in these tanks until mortalities began, at that time a n=100 sample of fry were transferred to Whatman paper for future genetic testing. The potential exists once a sex marker is identified that these samples could be analyzed and confirm if any of the MT100 fish were sex reversed.

MICHIGAN

Michigan Update to the NCD Walleye Technical Committee – January 2020

Submitted by Ed Roseman

From Dave Fielder – MI DNR "On Saginaw Bay, as you may recall, after reaching recovery targets in mid 2000s, the managers liberalized walleye harvest to try and biomanipulate better survival on yellow perch which were suffering from very high mortality between age-0 in the fall and the following year as age-1. It was deemed a predation mortality bottleneck to recruitment. The liberalized regulations (2017-present) did reduce the number of age-4 and older walleye but subsequent record walleye year classes has kept the overall population high (even increasing). It seems that the population (via its stock/recruitment function) is pushing back resisting getting smaller. There has been no benefit for perch as hoped. We are now right at the point of revisiting the management to devise new options and expectations. It is hoped that the new Cisco reintroduction stocking effort may result in a new prey buffer that may help take some of the pressure off of perch but that it a long-term solution and unclear if the reintroduction stocking will even take. More to follow."

From St. Clair-Detroit Rivers/Western Lake Erie – Very good and record walleye year classes in western Lake Erie are providing excellent walleye fishing in the rivers, Lake St. Clair, and western Lake Erie. Increased effort is resulting in crowded boat ramps and shore access areas. Need for increased/improved access is being considered.

MINNESOTA

2019 Minnesota- NCD Walleye Tech Committee Report

Report by Dale Logsdon

2019 Walleye Stocking:

255,387,799 fry

665 small fingerlings

1,269,523 large fingerlings

33,371 yearlings or adults

Personnel Changes:

Charles Anderson retired as fisheries supervisor and was succeeded in that position by John Hoxmeier. Gary Barnard retired as area supervisor in Bemidji and Gerry Albert retired as large lake specialist on Lake Winnibigoshish.

General:

Coordination with WI DNR resulted in proposed Mississippi River Pools 3-8 regs. change in walleye bag limit from 6 to 4 with a 15" min. and only 1 over 20". Border waters with South Dakota changed to continuous season for walleye (primarily Big Stone and Traverse Lakes) to align with SDGFP regs. MN DNR is in the process of updated statewide stocking and lake management plans to help better coordinate and direct walleye management across the state. A zebra mussel workgroup was also formed to help coordinate efforts to better understand the impacts of zebra mussel infestations and hopefully determine how to better manage walleyes in their presence.

DNR Research:

Loren Miller - We continue to examine genetic population structure of walleye statewide. A population near the headwaters of the Red River surprisingly looked more similar to southern Minnesota walleye populations than to others in the same drainage. South Dakota samples are being evaluated because SDGFP and MNDNR have stocked in this system.

Loren Miller, Dale Logsdon and Steve Shroyer - First year results comparing performance of Lower Mississippi strain walleye fry to that of the more easily obtainable Upper Mississippi strain walleye indicated both higher survival and faster growth of the Lower Mississippi stain walleyes in southern Minnesota lakes.

Beth Holbrook and Bethany Bethke - As part of a two year MN DNR collaborative research project, Yellow Perch were sampled in 19 lakes this past autumn using small-mesh gill nets and boat electrofishing to collect information on sex, maturity and growth. Early results indicated that across lakes, the length of 50% maturity for females varied over 100 mm (70 – 190 mm) and the maximum ages varied 12 years (5 – 17 yrs). Additionally, gear differences were detected, with female Yellow Perch exhibiting a longer length of maturity when captured with electrofishing. Five lakes will be resampled and an additional 12 lakes with be sampled in autumn 2020.

Heidi Rantala, Will French, Bethany Bethke, Tyler Ahrenstorff, Gretchen Hansen (U of M) - The Large Lake Food Web project (lead by Gretchen, but including many DNR staff) has a paper in press in Biological Invasions. We looked at YOY YEP and YOY WAE growth in the 9 large lakes (Lake Pepin was excluded) using the historical DNR data. We found that at the end of their first summer, WAE were on average 12 or 14% smaller in the presence of spiny water flea or zebra mussels, respectively. The results for YEP were less clear, although there was a trend of reduced first year growth in the presence of ZM. It is also interesting to note that first-year growth of those fish species was less coupled to temperature in the presence of either invasive invertebrate.

We just finished our first summer sampling for an extension of this project that focuses on 15 smaller lakes, half having ZM, half being uninvaded, to see how the large lake results translate to smaller systems. We are also working on a manuscript on the results of the stable isotope analyses from the large lake project.

University research:

Gretchen Hansen (U of M)

We recently had a paper accepted in Biological Invasions (referenced above) in which we documented declines in first year growth of walleye in Minnesota's large lakes associated with zebra mussel and spiny water flea invasion. No changes were detected in yellow perch first year growth: *Hansen, GJA, TD Ahrenstorff, BJ Bethke, J Dumke, J Hirsch, KE Kovalenko, JF LeDuc, RP Maki, HM Rantala, T Wagner. In press. Walleye growth declines following zebra mussel and Bythotrephes invasion. Biological Invasions*

I had a successful proposal to the GLFC to examine drivers of walleye recruitment across North America. This new project will involve a workshop bringing together walleye researchers/managers from the Great Lakes and inland lakes to develop a conceptual model of the drivers of walleye recruitment, as well as a data collation effort to synthesize stock, recruitment, and environmental variables to conduct a range-wide analysis of the drivers of walleye recruitment.

I also have several ongoing projects related to walleye:

1) Assessment of thermal optical habitat, its sensitivity to climate and clarity changes, and how it influences walleye populations in several hundred Minnesota lakes

2) Quantifying zebra mussel effects on walleye recruitment in Minnesota lakes using historical data

3) Assessment of food webs effects of zebra mussels in Minnesota walleye lakes using stable isotopes.

Andrew Hafs (Bemidji State)

Implications of Management Actions (Land-use Changes and Vegetation Removal) on Condition Shifts due to Trophic Cascades

Alicia Skolte, Casey Schoenebeck, Andrew Hafs

Management actions have been known to lead to condition shifts within lakes, and shallow lakes are especially vulnerable to these shifts. Ecosystem conditions exist as a continuum between turbid, algal-dominated and clear, macrophyte-dominated conditions. Lake Shaokatan, a shallow Southwestern Minnesota lake, has undergone a shift throughout the early 21st century towards a clear condition in correspondence with land-use changes. These land-use changes were accomplished through the rehabilitation of three feedlots, four wetland areas, and shoreline septic systems. A recent fluctuation in the summer of 2019, suggesting a shift towards a turbid condition, may have been initiated by the chemical removal of about 15 percent of vegetation within the lake basin. The primary objective of this study examined the long-term trends of water quality, percent phytoplankton composition, zooplankton and fish

relative biomass, as well as percent coverage of the littoral area by plants on Lake Shaokatan. Fish biomass was subdivided into piscivores and non-piscivores by the most prominent diet item in each species' adult stage. This study also documented how two management actions (land-use changes and chemical removal of vegetation) had a role in ecosystem shifts. The final objective investigated whether patterns of dissolved oxygen, water temperature, and phosphorus concentrations correlated with trophic level changes and/or served as indicators, along with taxon of plants or phytoplankton, of an oncoming shift in the ecosystem. Results of this proposed study would aid management agencies to make deliberate decisions and inform them of triggers for a condition shift. Data analyses and results are not yet available for this presentation.

Updated 16 January 2020

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

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

Mercury is a widespread contaminant that has resulted in regional and global studies over the past several decades. The largest freshwater lake completely within Minnesota, Upper and Lower Red Lake, has limited data on mercury. The Minnesota DNR and MPCA has been monitoring mercury in the Red Lakes since the late 1980's, however fish tissue sampling through these years has been sporadic. The objectives of this study is to (1) develop models for walleye to determine mercury concentration by length, age, sex, and lake basin; (2) statistically determine temporal variability and how mercury concentrations from the Red Lakes compare to similar large-lake systems; and (3) provide data to update the fish consumption advisory for Upper and Lower Red Lake. Walleye tissue samples were collected during the 2019 fall experimental gill netting assessment performed by the MN DNR and Red Lake DNR. These samples will be analyzed in the spring of 2020 using Atomic Absorption Spectrometry and data analysis using R.

Updated 16 January 2020

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

Joseph W. Amundson, Heather Marjamaa, Andrew W. Hafs, and Anthony J. Kennedy

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 methods, it has been found that age-0 Walleye stocked in Lake Andrusia disperse throughout the well-connected lakes of Cass Lake Chain by late August (Figure 1) with total length (TL) at day 239 differing by lake (Figure 1). As fry disperse the catch-per-unit-effort (CPUE) generally decreases the farther they travel from the stocking site in Lake Andrusia and total length (TL) is generally larger with decreased CPUE. Further analysis needs to be done to see if these results have any biological significance to the survival and subsequent year class strength. Fish from the chain wide lake assessment, done during the 2019 field season, are currently being processed. Walleye from the 2016 cohort will be used to determine stocked fish recruitment to the fishery.

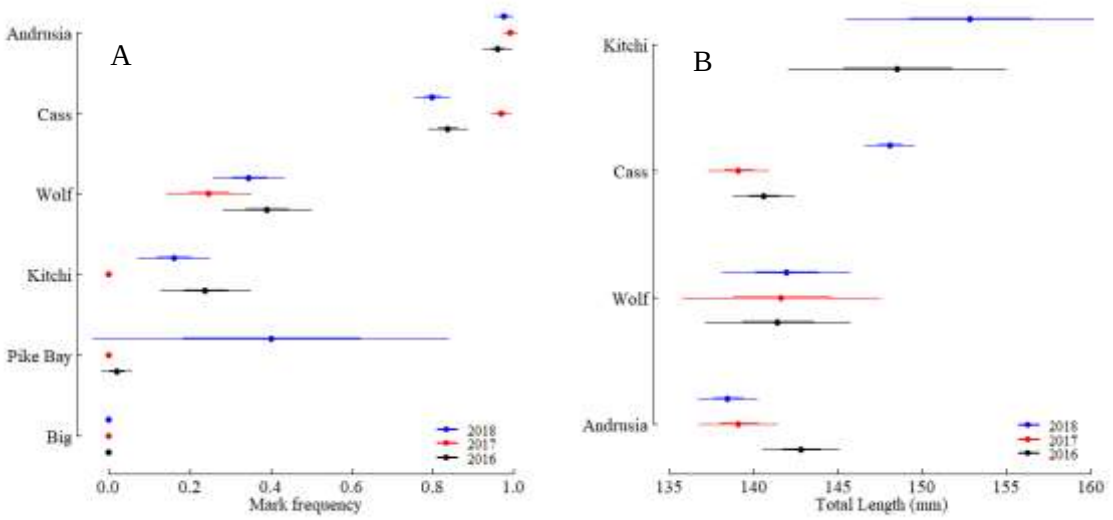


FIGURE 1. A) Age-0 Walleye OTC marking frequency for each lake by year. Dot represents marking frequency with lines representing one and two standard errors. B) Marked age-0 Walleye mean total length (mm) for each lake (n > 5) by year. Dot represents mean length at day 239 with lines representing one and two standard errors.

Updated 21 January 2020

Exploitation of Walleye and Yellow Perch by Double-crested Cormorants in Leech Lake, MN

Cody Coyle, Andrew Hafs, Doug Schultz, and Carl Pedersen

The primary objectives for this project are to (1) estimate abundance and mortality for juvenile Walleye and Yellow Perch in Leech Lake pre and post cormorant reintroduction and (2) measure consumption of fishes by Double Crested Cormorants (DCCO). Walleye and Yellow Perch abundance was estimated using previous trawl and standardized netting surveys. Daily and annual DCCO consumption is estimated through a bioenergetics model that was developed by the MN DNR. Estimates of consumption from DCCO will be compared to abundance estimates to determine the level of exploitation DCCO are having on the fisheries, with Walleye and Yellow Perch being the primary focus. DCCO diets were dominated by age-0 and age-1 fishes, but fish as old as age-3 were observed. It appears that DCCO exploitation rates are higher in age-0 Walleye than Yellow Perch (Figure A). It was estimated that DCCO consumed 4.04 pounds of fish per acre in 2019 (Figure B), which is slightly higher than the target goal of 3.5 pounds per acre. Exploitation rates appear to be directly related to DCCO population size, with the highest levels of exploitation occurring during the mid-2000s when bird populations were uncontrolled. Future diet work is expected to examine how diets change with the introduction and establishment of Zebra Muscles.

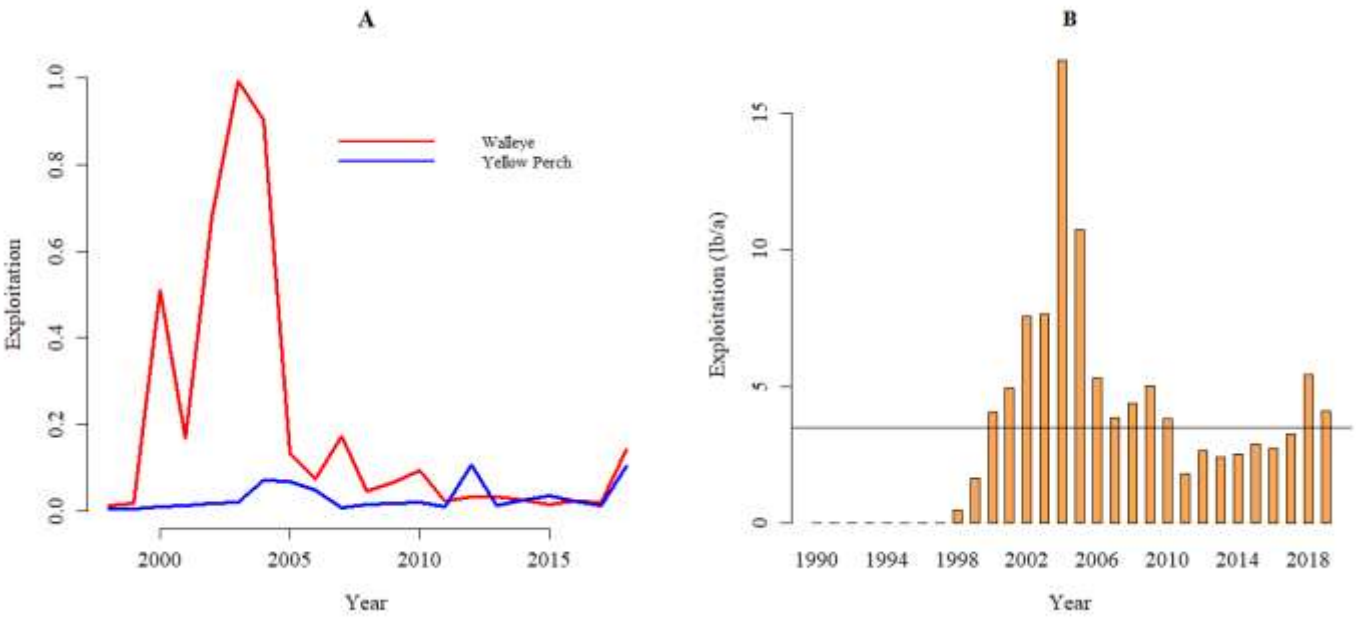


Figure 3. Exploitation rates of age-0 Walleye and Yellow Perch (A) and exploitation of all fishes expressed in pounds consumed per acre (B).

Updated 21 January 2020

Diet Overlap of Piscivores in Minnesota Lakes

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

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 is to use diet samples from Walleye, Largemouth Bass, Northern Pike, and Muskellunge to quantify the seasonal feeding niche of each species. Fish will be sampled using a variety of gears including, but not limited to, Fyke nets, large frame trap nets, electrofishing, gill nets, and angling. Diets will be collected using pulsed gastric lavage and compared among a set of lakes with varying prey fish assemblages in an attempt to determine potential interspecific competition between species. Currently, 14 lakes spread across the northern portion of the state have been chosen for inclusion in this study. Diet samples will also be used to verify stable isotope samples collected from the same set of lakes. Diets from 586 Walleye, 510 Largemouth Bass, 644 Northern Pike, and 165 Muskellunge were collected in the 2019 field season, and analysis is ongoing.

Updated 16 January 2020

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.

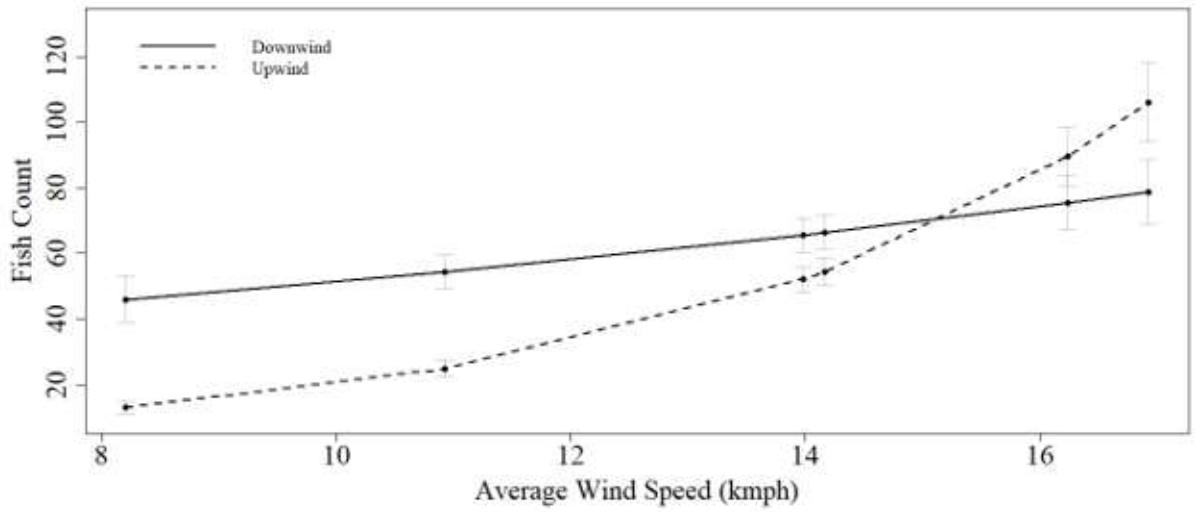


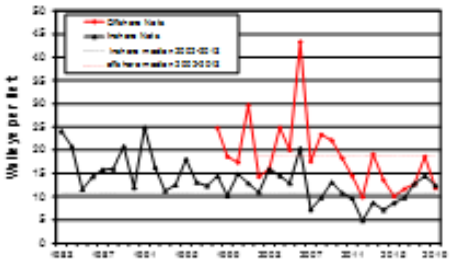
Figure 1. Change in predicted mean fish count in the upwind and downwind sectors of Blackduck Lake, as affected by varying wind speeds (kmph) during the 26 Jun – 07 Jul 17 sampling period. Error bars represent standard error.

Project completed January 2019

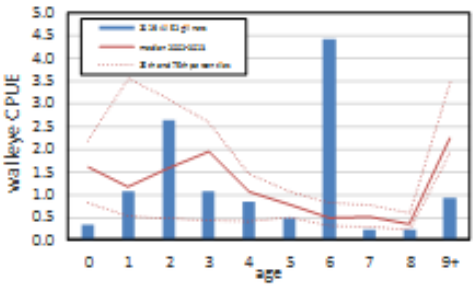
Large lake updates:

Mille Lacs – Eric Jensen

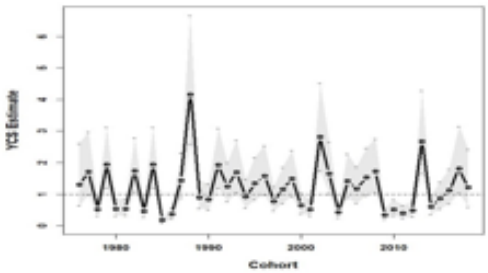
Walleye in the Fall Gill Nets



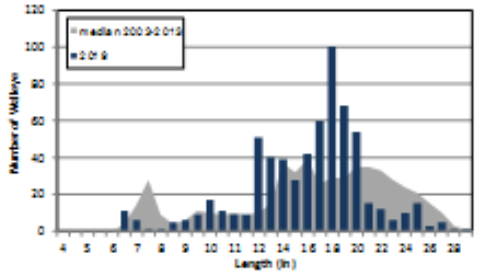
2019 Walleye age frequency from all 52 nets



Walleye age 1 – 3 YCS index

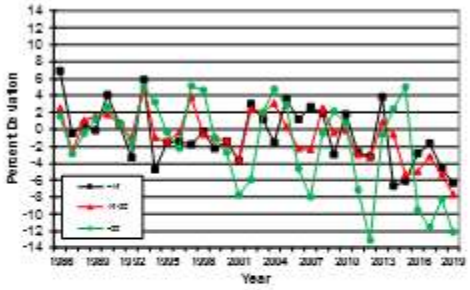


Walleye LFD – Inshore Gill Nets



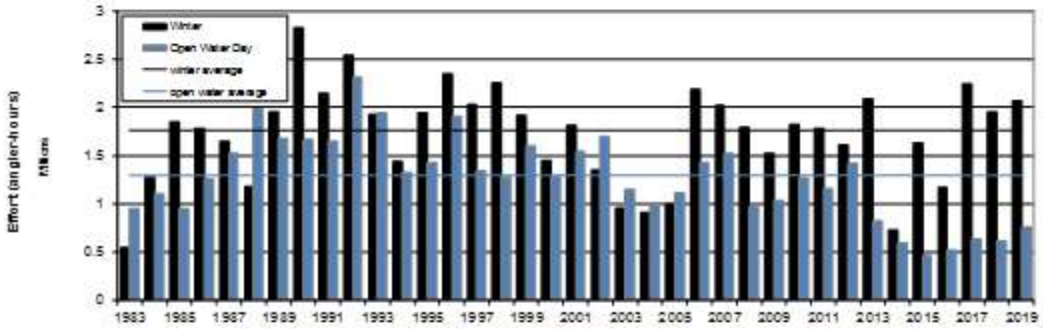
- Walleye numbers decreased from the previous year in both the inshore and offshore nets, where 2019 CPUE in the inshore nets remained above median and the CPUE in the offshore nets dropped below the 25th quartile. 2019 CPUEs were similar to the 2017 catches. A 2018 spring mark-recapture population estimate suggested that the 2018 gill net catches may have been up to 30% too high, indicating that the 2018 fall gill net CPUEs are likely the anomalous points. The offshore gill nets typically maintain a higher Walleye CPUE than the inshore nets; however, the 2019 CPUEs from both sets of nets were nearly identical, similar to what was observed in 2017.
- The 2013 year class of Walleye continue to make up the largest age group of fish observed in the fall sampling (about 35%). The 2014 Walleye year class is now below the 25th percentile; however, the 2015 through 2018 year classes are all well above the 25th percentile, with the 2017 year class continuing to show up in strong numbers at above the 60th percentile, suggesting likely high future recruitment into the spawning stock.
- Fall electro-fishing catch rate of YOY and age 1 Walleye were both just above the 30th percentile at 130 Walleye/br and 9.4 Walleye/br, respectively. Age 0 Walleye in the forage gill nets exhibited a similar trend; however, the catch rate of 2.1 Walleye/net was just above median in the much shorter time series for this gear. Age 1 CPE from both the gill nets and electrofishing provide a strong indication of year class strength.
- Fall condition factors for Walleye across all size classes were the lowest to second lowest ever observed. High angler catch rates for Walleye during the 2019 winter and summer angling seasons were likely due to hungry fish; however, age 0 Yellow Perch and age 0 Tullibee, the typical preferred prey of Mille Lacs Walleye, provided a conflicting view of forage levels as they were sampled at above median levels in the forage gill nets.
- Winter angling pressure (Dec 2018 – March 2019) was about 17.5% above average, mainly due to good ice conditions and a Walleye catch rate of 0.08 fish/angler-hour, which is twice the average winter catch rate. Summer angler effort continues to steadily improve from the lowest observed in 2015, but still remains at about 58% of the average, despite very high Walleye catch rates. Total State recreational Walleye kill was estimated at 92,850 lbs from a safe allocation of 87,800 lbs, with hooking mortality accounting for about 64,000 lbs of kill and harvest contributing an additional 28,900 lbs.

Fall Walleye Condition

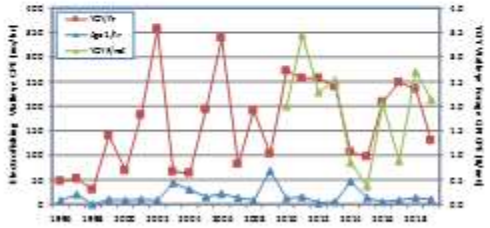


Yellow Perch in the Forage Gill Nets

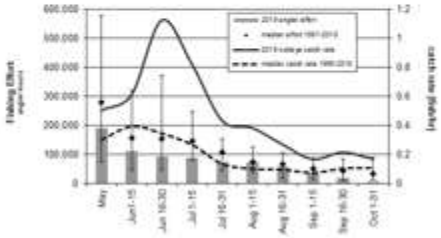
Mille Lacs Angling Pressure



Electrofishing Walleye Catch Rates



Summer Effort and Walleye Catch Rate



Lake of the Woods - Brett Nelson

Attached is a copy of the mini report for Lake of the Woods. As far as recent findings go, last winter marked record fishing pressure and above average harvest for both Walleye and Sauger. Also the discovery of zebra mussel zeligers in Muskeg Bay this past summer.

Walleye and Sauger Stock Status Update: Lake of the Woods - 2019

Walleye

Walleye catch in the 2019 gill net sample averaged 18.3 per net, which is above the 2002 to 2018 average of 16.8 (Figure 1).

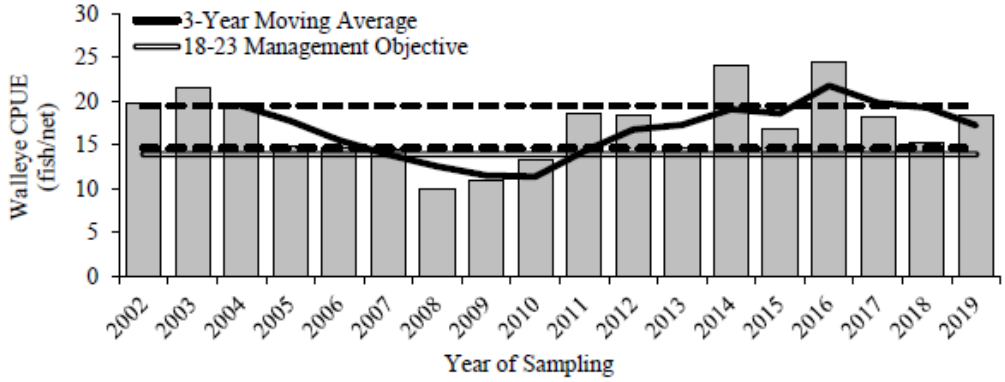


Figure 1. Average of near shore and off shore catch per unit effort of Walleye in September gill nets, 2002 through 2019.

The 2011, 2013 and 2014 year classes were strong, while 2015 and 2016 year classes are of average strength (Figure 2). The 2017 year became recruited to gill nets in 2019 and is weakest year class since 2004. The 2018 and 2019 year classes are predicted to be strong (based on YOY growth and abundance).

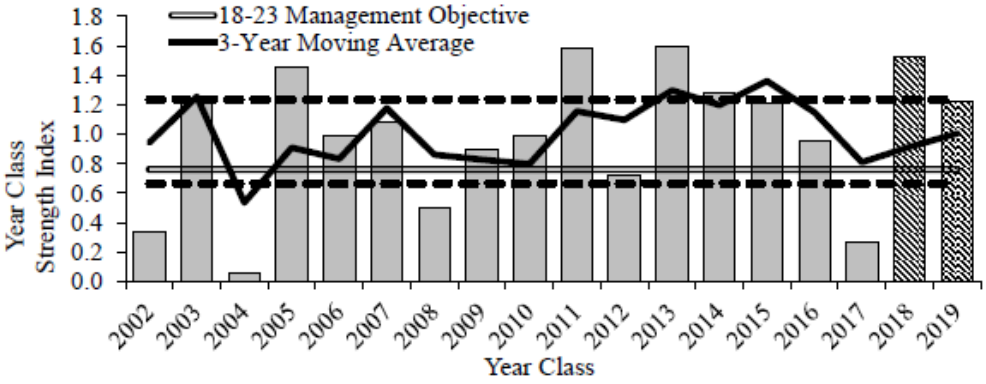


Figure 2. Year class strength of Walleye in Lake of the Woods from 2002-2019. Fished hatched in 2018 and 2019 and not considered fully vulnerable to gill nets; therefore strength values are predicted.

Small Walleye, from 8 to 10 inches long are abundant (2018 year class). Harvestable-sized Walleye (14-18 inches) are also abundant and these fish are likely from 2011-2014 year classes (Figure 3).

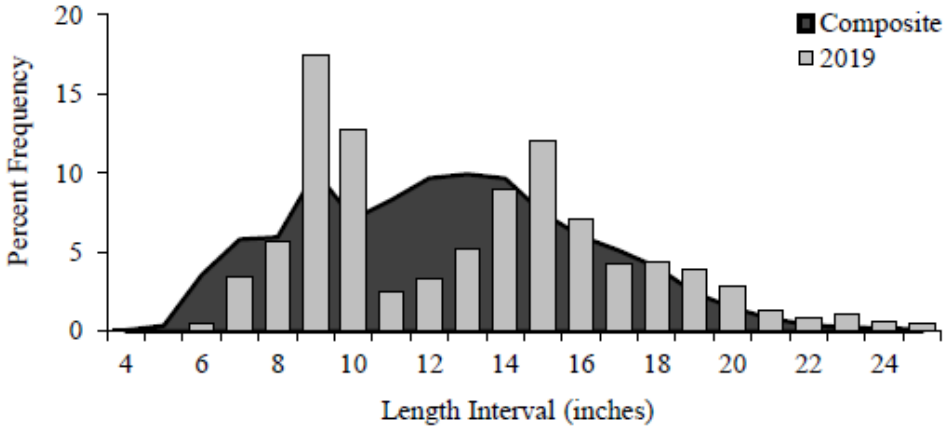


Figure 3. Walleye size distribution from 2018 fall gill net survey (gray bars). Shaded area denotes the average length frequency from 1981-2017.

Sauger

The highest Sauger abundance measured in the fall gill net assessment since 2002 was 30.8 Sauger per lift, which was observed in 2008 (Figure 4). High abundance was driven by young Sauger from strong year classes produced from 2005 through 2007 (Figure 5). In recent years, strong year classes were produced in 2011, 2015 and 2017 (in addition 2014 and 2016 were near the strong threshold). Recent year classes are predicted to be average (2019) to weak (2018) in strength.

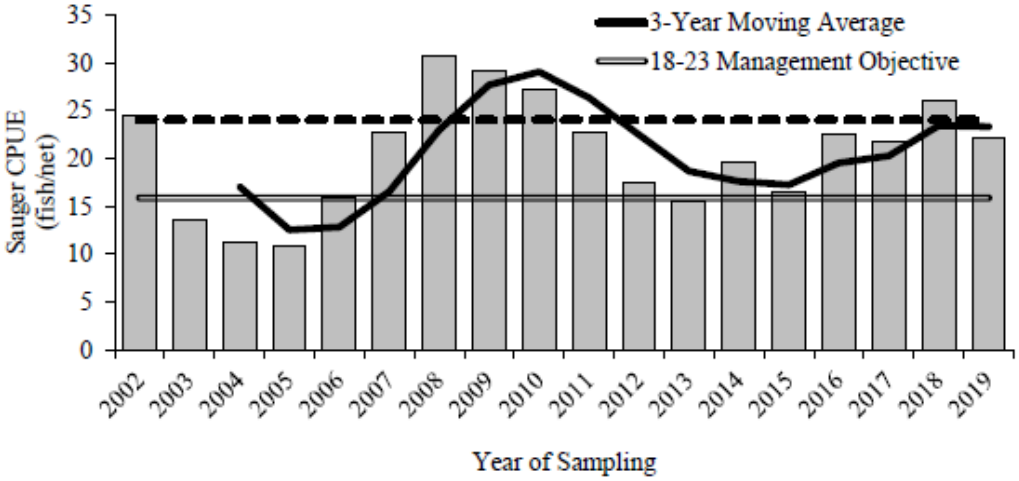


Figure 4. Average of near shore and off shore catch per unit effort of Sauger in September gill nets, 2002 through 2018.

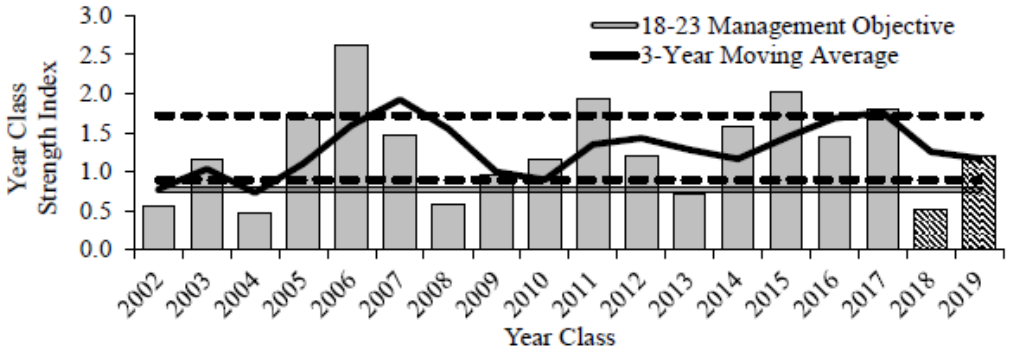


Figure 5. Year class strength of Sauger in Lake of the Woods from 2002-2019. Fished hatched in 2018 and 2019 and not considered fully vulnerable to gill nets; therefore strength values are predicted.

Currently, there is a quality size distribution of Sauger (Figure 6). Of interest to anglers is that Sauger from 13 to 16 inches were relatively abundant, and individuals over 19 inches long were sampled. Fish less than 10 inches were below the long-term average; likely due to the 2018 year class that is predicted to weak.

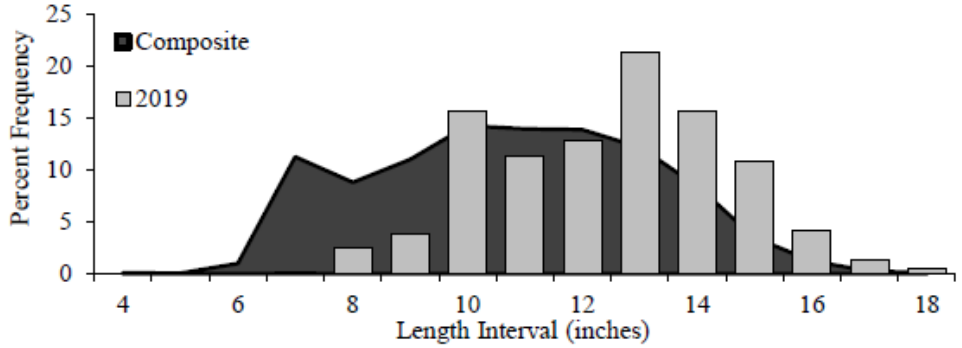


Figure 6. Sauger size distribution from 2019 fall gill net survey (gray bars). Shaded area denotes the average length frequency from 1984-2018.

Creel Survey Highlights

- Summer 2019: Fishing pressure was estimated 760,000 angler-hours and is above the six year average (~700,000 angler hours). Walleye (270,000 pounds) and Sauger (95,000 pounds) harvest were above 2013-2018 average. Since 2013, average summer harvest for Walleye has been 230,000 pounds and 70,000 pounds for Sauger.

- Winter 2018-2019: Fishing pressure and Walleye/Sauger harvest were either near or was the highest recorded. Winter fishing pressure was estimated at 2.1 million angler-hours, approximately 200,000 angler-hours above average. The 2013-2018 average winter harvest is 215,000 pounds for Walleye and 300,000 pounds for Sauger. Winter harvest in 2018-19 was 370,000 pounds for Walleye, and 479,000 pounds for Sauger.

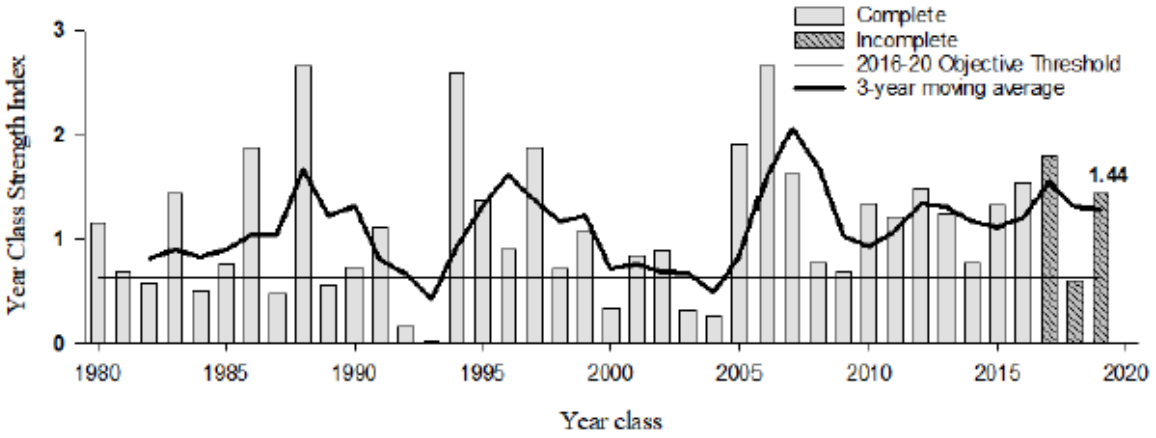
Leech Lake – Carl Pedersen

MN DNR Fisheries Management Actions and Surveys on Leech Lake: 2019

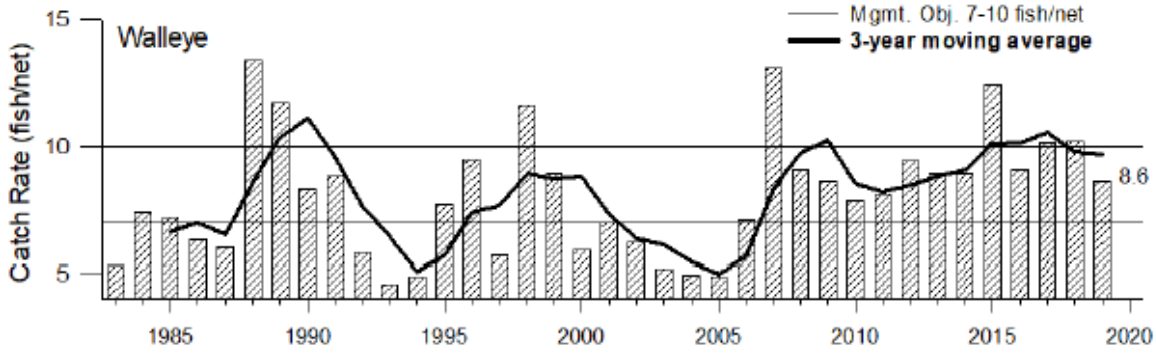
Young-of-Year Walleye Growth and Abundance

- July Seining: The average length (2.5 in.) was below the long-term average of 3.3 inches and the number sampled per acre (8.6) was below the long-term average of 66.
- August Trawling: The average length (4.9 in.) was below the long-term average of 5.3 inches while the number sampled per hour (361), was above the long-term average of 184.
- September Electrofishing: The average length (6.2 in) was above the long-term average of 6.0 inches. Walleye recruitment is generally higher when mean September length exceeds 6.0 inches. The number sampled per hour (104) was above the long-term average of 100.

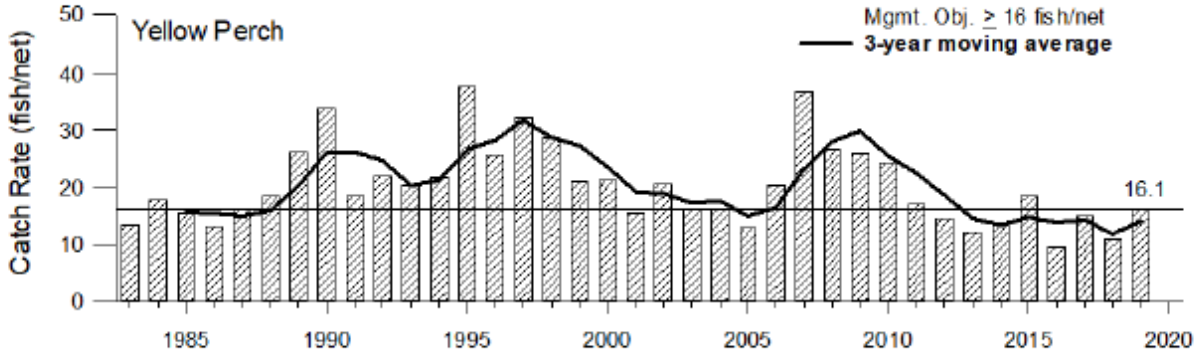
Walleye Recruitment: Year class strength index values are determined from gill net catch of ages 1-3 and predicted for age-0 from gill net and trawl catch data. Incomplete values for 2017 (1.80) and 2019 (1.44) cohorts exceed the management plan objective threshold (0.66) with the 2018 predicted year class (0.61) just below. The 3-year running average (1.28) is above the objective threshold.



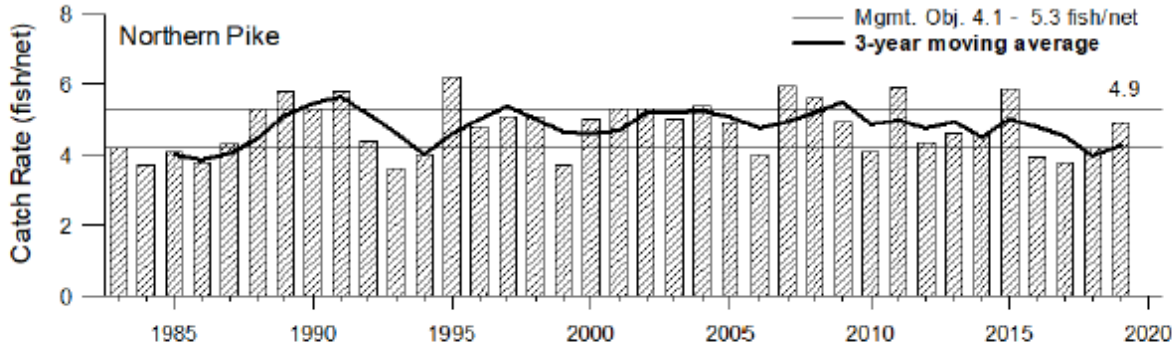
Walleye Abundance and Size Range: The gill net catch rate of 8.6 fish/net was within the management objective range (7-10 fish/net). Lengths of Walleye sampled ranged from 6 to 28 inches and demonstrated a balanced size distribution.



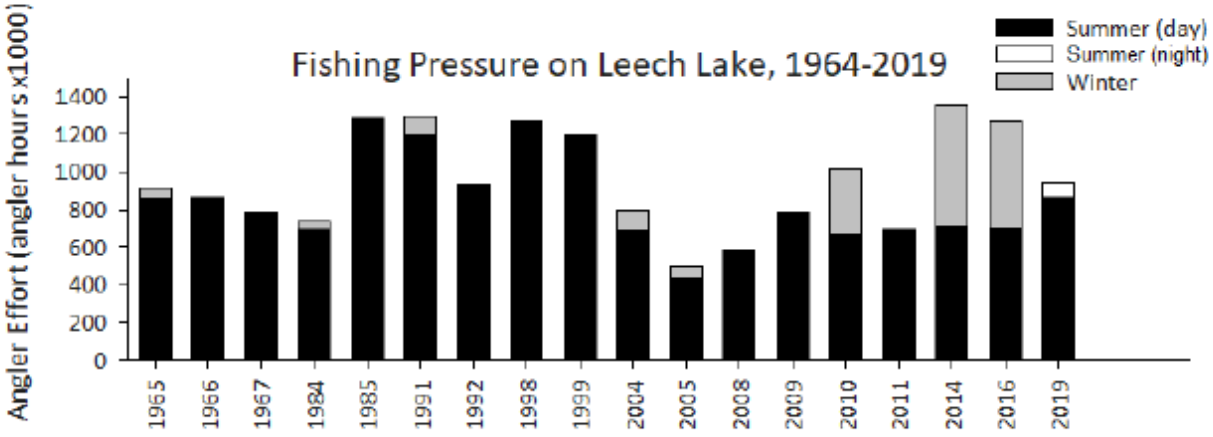
Yellow Perch Abundance and Size Range: The gill net catch rate (16.1 fish/net) was just above the management plan objective of at least 16 perch per net. Perch up to 12 inches long were sampled.



Northern Pike Abundance and Size Range: The Northern Pike gill net catch rate (4.9 fish/net) was within management plan objectives. Pike up to 36 inches were sampled.



Seasonal Angling Pressure: Angling pressure was within historical averages. Additionally, a nighttime summer component was added to the 2019 summer creel survey to develop and estimate the amount of angling that occurs in the first few hours after dark.



Please direct questions or comments to:
Carl Pedersen, Large Lake Specialist, Walker Area Fisheries, Carl.Pedersen@state.mn.us (218) 547-1683
Doug Schultz, Area Supervisor, Walker Area Fisheries, Doug.W.Schultz@state.mn.us (218) 547-1683

Winnibigoshish – Dave Weitzel

2019 Fisheries Survey Results for Lake Winnibigoshish

Surveys included summer seining, zooplankton sampling, fall electrofishing, and water quality sampling. The 2019 fall gill net survey was conducted from September 15 through September 26th. Thirty two nets were set around the lake, sampling all habitat types.

- Gill net catch rates for all fish were relatively low in 2019. Catch rates were likely affected by filamentous algae fouling of the nets and poor weather during sampling. Gill net catch rates and associated indices are likely biased.

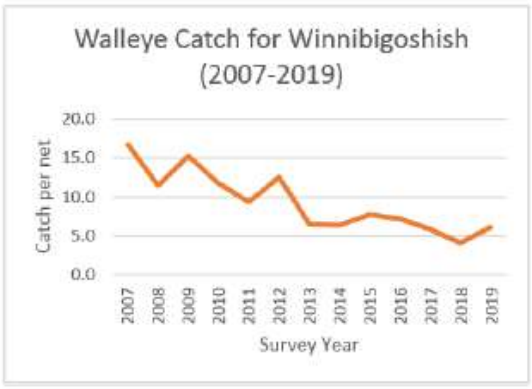
- Biological measurements continue to indicate a healthy Walleye population with appropriate harvest levels. In 2019, Walleye lengths ranged from 6.9 to 26.1 inches and averaged 14.5 inches, indicating a diverse size structure. Age analysis indicated 15 year classes were present, ranging from age 0 to 14. Poor recruitment occurred from 2014-2017, but improved in 2018 and 2019. Electrofishing in 2019 resulted in high catches of young of the year Walleye. The 2018 and 2019 year classes were well represented, suggesting good initial survival from these years. The 2013 year class remains the strongest class of adult fish. Growth rates have been above the statewide average in the last three assessments. A female spawning stock biomass of one to two pounds per acre is considered optimal for natural reproduction on Winnibigoshish. Surveys in 2018 and 2019 resulted in estimates of 1.1 pounds per acre. Age and length at maturity are also useful indicators to determine appropriate harvest levels and relative population status. Since 2007, female Walleye on Winnibigoshish typically reached maturity in 3.5 years at 17.3 inches. Both values are near statewide standards and suggest appropriate harvest levels have occurred.

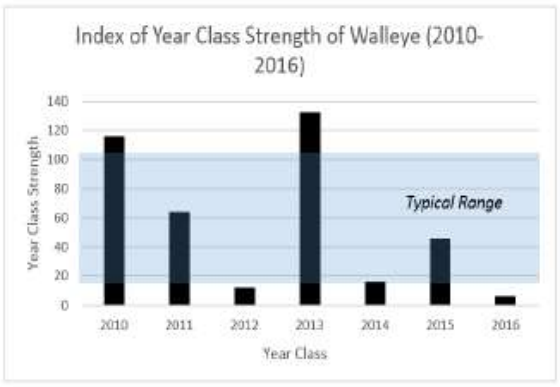
- The gill net catch rate for Yellow Perch remained near the historic low. Perch length ranged from 5.4 to 11.7 inches and averaged 7.2 inches in 2019. The number of perch over 9 inches was below average for Winnibigoshish in 2019, but indicate that some opportunities for catching large perch continue to exist.

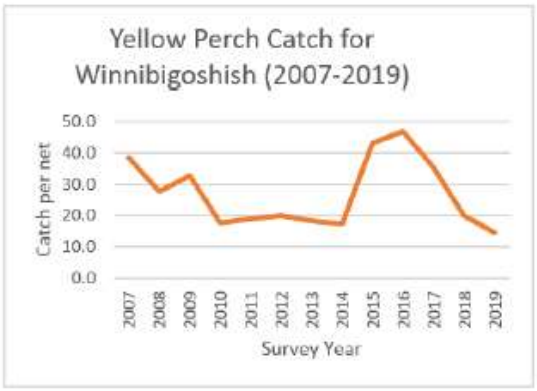
- The Northern Pike catch was typical for lakes with similar habitats and for Winnibigoshish. Lengths ranged from 10.4 to 32.7 inches in 2019, and averaged 22 inches. Only 3% of the sampled pike exceeded 28 inches, but the presence of fish over 30 inches indicates that some angling opportunities for large pike exist. As in past surveys, recruitment was consistent, with ages 0-8 present. Growth was similar to past surveys and near the statewide average.

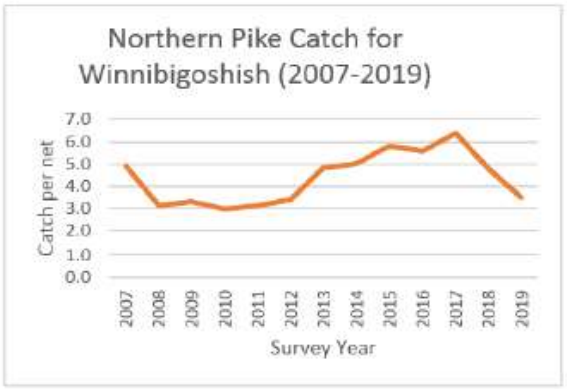
- Cisco catches have declined dramatically on Winnibigoshish, following a trend observed across Minnesota. The 2019 catch was the lowest observed and is the seventh consecutive survey with a below average catch. The impact of cisco declines is unknown, but could negatively impact growth rate of large predators such as Northern Pike, Muskellunge, and Walleye.

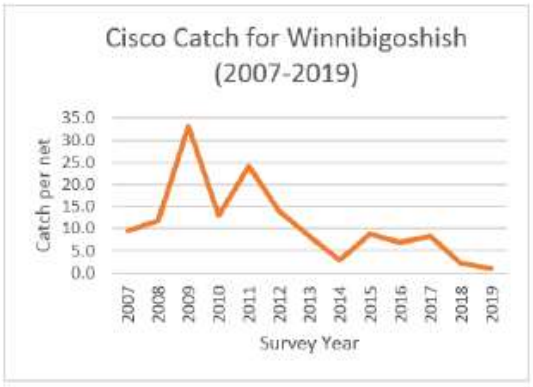
- Exotic Aquatic Species- Several species have been introduced into Winnibigoshish. Three species of snail: Banded Mystery, Chinese Mystery, and Faucet have become established since 2000. Juvenile Zebra Mussels (veliger) were discovered while sampling zooplankton during the summer of 2012. Adults were found on near shore driftwood in the early summer of 2016. Starry Stonewort was discovered along the south and west shores of the lake in 2016, and appears to have been established for several years.











Lake Pepin – Nick Schlesser

Messed up creel from all our high water is slowing up my processing of 2019 data, but preliminarily it looks like 2018 is a monster WAE year class on Pepin. Trawl data says that 2019 is about the same (actually slightly higher catch rate and more consistent overall larger size than 2018 YOY), but we were flooded out of our fall EF sample so no confirmation yet.

As far as we know new regulations on the Mississippi River border waters including Lake Pepin will go into effect sometime this spring (target of March 1st MN and April 1st WI, but delays occurring in both state capitals). Regulation will go from 6 bag combined WAE & SAR with a 15" min on WAE to a 4 bag

combined on WAE & SAR with a 15” min on WAE and 1 over 20” daily of either species (only 1 WAE or 1 SAR not both) for border water portions of Pools 3 – 8. Our small portion of Pool 9 will get the IA slot regulation 6 combined total (15" minimum size for walleye, all walleye from 20-27" must be immediately released, only 1 walleye over 27")

MISSOURI

2019 Missouri NCD Walleye Tech Committee Report

Submitted by Ben Parnell

2019 Walleye Summary for Stockton Lake

Ben Parnell, Fisheries Management Biologist, Missouri Department of Conservation

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The Stockton Lake Walleye population is assessed by spring electrofishing for adults in the dam area and fall electrofishing for YOY at different locations throughout the lake. Walleye were sampled in the dam area in late March of 2019, resulting in a CPUE of 75 Walleye per hour. Walleye PSD (15) and RSD (20) values were 94% and 23% respectively. Walleye growth continues to be good with most fish reaching the 15-inch minimum length limit as age two fish. Mean average length of age three male Walleyes has been almost 17 inches, which falls within our objective of 16-18 inches.

In late May of 2019, Stockton Lake was stocked with approximately 300,900 Walleye fingerlings (12 fish per surface acre). This exceeded our annual stocking request of 300,000 Walleye fingerlings (<4”). Unfortunately, many of our other reservoirs failed to meet stocking requests due to poor Walleye production throughout our hatchery system (see hatchery reports).

Smithville Lake 2019

Stocked 216,000 <2" walleye fingerlings in 2019. This year we experienced extreme cold/rain during spring walleye sampling. Catch rates for 2019 are listed below.

Walleye	2019
Effort (hr)	0.98
CPUE - EF (>8"/hr)	317
PSD(15)	76
RSD (20)	49

Lost Valley Hatchery Walleye Production Summery 2019

For the 2019 walleye production season in the month of March, Lost Valley Hatchery used 103 females and 74 male walleyes for spawning purposes. Hatchery staff were able to hatch off 52.8% of the

17,168,000 walleye eggs that were collected from the females. Once the eggs hatched off, walleye fry were moved to multiple locations. Blind Pony Hatchery received 599,995 fry to stock in their production ponds, Lost Valley placed 2,126,731 into their production ponds, and Lake of the Ozarks was stocked with 3,455,108 fry. Once in the ponds at Lost Valley, the fish were monitored and allowed to grow for a month and a half before being harvested in early to mid-May. Fingerling production was poor this year and only 196,282 walleyes were produced. Stockton Lake received 181,282 of the fingerlings while 15,000 were held back at Lost Valley to be grown to a larger size. These grow out walleye were held in Lost Valley's production room throughout the summer and converted over to artificial feed. Of these fish brought inside for grow out 6,491 walleyes survived and averaged 4.9 inches at the time of their stocking into Forest Lake at Thousand Hills State Park in October.

2019 Walleye Summary for Bull Shoals Lake and Norfork Lake

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- **Norfork Lake:** Walleye were sampled in the North Fork of the White River, Bryant Creek, and the HWY 160 bridge area near Tecumseh on March 11th. Walleye congregate in the upper end of the lake and in the rivers during the late winter and early spring to spawn. Biologists collected approximately 95 Walleye in 1.39 hours (68 fish per hour), which were almost exclusively male. A total of 19 males and 11 females were collected for Mercury testing, requested by DNR, Fisheries Division, and Resource Science Division, to be used for statewide Mercury monitoring. Results are pending. Walleye brood stock were collected from Lake of the Ozarks/Lost Valley Hatchery and spawned at Chesapeake Hatchery in Mount Vernon, MO. Brood stock collection, spawning, and fry culture was successful. As a result, approximately 175,275 fingerlings were stocked in Norfork Lake in 2019. Norfork Lake's production request was 176,000 fingerlings with a surplus request of 44,000 fingerlings. Since other hatcheries lacked in Walleye production this year, Chesapeake could not stock surplus fingerlings into Norfork Lake, and instead, met other statewide requests.

- **Bull Shoals Lake:** Walleye brood stock were collected from Lake of the Ozarks/Lost Valley Hatchery, instead of Bull Shoals Lake, and spawned at Chesapeake Hatchery in Mount Vernon, MO. Brood stock collection, spawning, and fry culture was successful. As a result, a total of 387,087 Walleye fingerlings were stocked in Bull Shoals Lake in 2019. Bull Shoals Lake's production request was 384,000 fingerlings with a surplus request of 96,000 fingerlings. Stockings are split among three areas of the lake: Forsyth Arm (K-dock), Big Creek Arm (Noland's Point), and the Theodosia Arm.

Forest Lake 2019

Approximately 6,688 advanced walleye fingerlings were stocked into Forest Lake this October. This number exceeded my request of 5,730 fish (10/ac.) and they averaged 4.9 inches in length.

PRELIMINARY ANALYSIS OF MIGRATION AND SPAWNING OF WALLEYE

IN THE LOWER NIANGUA RIVER

Christina Kelsay[1], Zach Ford[1], Greg Stoner[2], and Jason Persinger[1]

Missouri Department of Conservation

Resource Science Division[1] and Fisheries Division[2]

EXECUTIVE SUMMARY

Migratory fish sampling was conducted downstream of Tunnel Dam on the Niangua River to determine the use of the lower Niangua River for spawning congregations of Walleye. A pilot year of reconnaissance sampling was conducted in the spring of 2017 at 5 different sites to look for the presence/absence of Walleye. Walleye were found at two of the downstream sites in the return reach in 2017. Extensive sampling occurred in March and April of 2018 and 2019 to locate additional spawning congregations of Walleye. Eight sites were sampled in 2018, and 55 Walleye were sampled (54 were tagged with Floy tags). In 2019, all eight sites were sampled again, and 214 Walleye were sampled (201 were tagged), To date, there has been a 7% recapture rate; 4 were caught by anglers, 15 were recaptured during subsequent migratory and fish community sampling efforts.

NEBRASKA

2019 Nebraska NCD Walleye Tech Committee Report

Submitted By Joe Rydell

Walleye Eggs were collected in 2019 from Sherman and Merritt Reservoirs. Walleye abundance is exceptional in Merritt Reservoir and our egg take was going so well that rather than going to Lake McConaughy like past years, we went back to Merritt for a late run and took all the eggs we needed. A total of 572 quarts of eggs were collected from Sherman and Merritt to meet the Nebraska hatchery demands and trade with Gavens Point NFH and Oklahoma for other fish production needs in Nebraska. Percent eye up was good this year with Sherman eggs at 68.5% eye up (worse than past years) and Merritt at 72.4% eye up (better than most years). Nebraska walleye eggs were used for both walleye production and saugeye production. Along with Nebraska walleye egg take, the hatchery staff conducted a Thyamine study to try and improve egg eye up percentage. These results were presented at the 2019 summer walleye Tech meeting in Webster, SD.

Research projects going on in Nebraska:

UNK Projects.

The Harlan and McConaughy projects are still ongoing. In Harlan, they're looking at water quality, zooplankton, and fish community difference between connected, intermittently disconnected, and completely disconnected coves. Walleyes are found more often in coves that are connected (not surprising), but they don't make up too much of our catches.

In McConaughy, we're looking to build a "heat map" that will help to decide where to stock walleyes to avoid predators, find food (zooplankton), and find "cover" (in the form of turbidity). The map is

expected to be completed by summer or fall of 2019. This information may be ready to present at the 2020 summer meeting.

They are also looking at percent stock contribution of walleye in Harlin and Big Mac with hopes of running modeling on what is driving natural recruitment as well as conditions that are reflective of stocking success (or failures).

Another project they are continuing is the 5th and last year of sex specific population assessment from Sherman Reservoir walleye spawning population. The goal is to develop understanding of the development of male and female walleye in the face of heavy angling harvest and a minimum length limit with closed slot regulation. These results will probably be summarized in a couple years.

Meetings

In July 2019 Derrick Schacht, Bryan, Sweet Keith Koupal, Jeff Schuckman, Sean Farrier, Al Hanson, Zac Brashears, Brad Eifert, and Joe Rydell attended the AFS joint Centrarchid, Esocid, and Walleye Technical Committee Meeting in Webster, SD. The joint meeting included production symposium. Bryan Sweet shared how Nebraska conducts walleye egg take each year with some results from a side Thyamine study. Derrick Schacht gave a presentation on spawning largemouth bass in raceways rather than ponds using spawning mats.

NORTH DAKOTA

North Dakota 2019 NCD Walleye Technical Committee Report

Submitted by Todd Caspers

The walleye population in Devils Lake is doing all right. 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 conducted our Standard Adult Sampling on Devils Lake in July. The overall CPUE of walleye increased a bit to 26 walleye/net-night in our 125' variegated gill nets. (22 last year) This year's catch is above the long-term average of 20.9 walleye/net-night. Size structure was relatively small though as 79% of the walleye were less than 15" long. One thing that was disappointing was that the catch rate of Q-P sized walleye was only about 4 this year, which is below the long-term average of about 5.7. The northern pike were a bit above the long-term average, while yellow perch numbers were below average. White bass numbers were lower than the record high observed last year, but we set a new record high for white bass numbers in the 12"-15" size group. Most of the white bass are from the strong hatch that we observed in 2015, and they are mostly about 12 to 14 inches long now. Due to relatively low numbers of 15"-20" walleye the past few years, we decided to stock walleye in 2019. About 900,000 fingerling walleye were stocked in 2019.

We are also in the midst of another creel survey at Devils Lake. The survey covers the periods of May 15, to August 31, 2019, and also December 1, 2019 through March 31, 2020. During the summer period, there were about 552,500 angler hours, and anglers harvested about 218,000

walleye, 16,400 pike, 164,000 white bass, 2,500 yellow perch, and 270 black crappie. Nonresidents continue to make up a significant proportion of anglers at Devils Lake, as nonresidents made up about 50.3 percent of open-water anglers.

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 19 walleye per net, which is above the long-term average of about 17 walleye per net. The yellow perch and northern pike were below their long-term averages, whereas white bass numbers were a bit above average. We are also conducting a creel survey at Stump Lake in conjunction with the Devils Lake creel survey. The survey runs from May 15th through August 31, 2019 and also from December 1, 2019, through March 31st, 2020. During the summer period, there were approximately 36,900 angler-hours, and anglers harvested about 9,000 walleye, 4,400 white bass, 350 pike, and 75 perch. Residents made up about 72% of the anglers in the summer period.

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. We are still relatively wet and the fish populations have responded very well to the abundance of water. However, some waters had receded to the point where there were concerns about them, but this fall was very wet and many waters refilled. Statewide, there are about 440 waterbodies that are being managed for fishing. This is a great increase from only about 175 managed fisheries in the early 1990's. Since 1997 we have added about 107 new walleye fisheries. State-wide there are currently about 150 waters that have fishable walleye populations. Even since 2012, we have added 45 new walleye lakes, although not all of them are providing a fishery yet. 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 department stocked walleye in 151 lakes in 2019. About 11.8 million fingerlings were stocked by our department. The fingerlings were generally about 30 days old and were around 1.25" long, but some advanced fingerlings were stocked as well.

In addition to the known zebra mussel population in the Red River, zebra mussels were also found in Lake Ashtabula this year. A new law was also passed to establish an Aquatic Nuisance Species Program Fund to provide additional funding to manage ANS issues. As part of this law, an additional ANS biologist was hired and an additional game warden was hired. Funding will come from an additional $15 charge on resident boat registrations and a $2 charge on some resident licenses. Out of state boats will need to pay a yearly $15 fee to obtain an ANS sticker, and some non-resident licenses will have an addition $3 charge.

SOUTH DAKOTA

2019 South Dakota NCD Walleye Tech Committee Report

Submitted By Mark Fincel

Northeast, SD, Region

Saugeye stocking

Elm Lake (Brown County, 480 hectare), Richmond Lake (Brown County; 333 hectare) and Mina Lake (Edmunds County, 326 hectare) are impoundments located in northeast South Dakota. Saugeye stockings began in 2016 after years of poor success with walleye stockings. Fall electrofishing for age-0 Sander spp. has indicated the potential presence of year classes. Plans are to continue to stock saugeyes and evaluate year class contribution to gill net CPUE once recruited.

	Age-0 electrofishing CPUE (#/hr)			
Lake	2016	2017	2018	2019
Elm	89.5	109.5	112.0	153.0
Richmond	10.5[a]	36.0	109.0	112.5
Mina	77.6	133.5	74.0	99.0

Southeast, SD, Region

In 2019, we began to evaluate Yellow Perch stockings in a variety of waterbodies, including lakes which had recently winterkilled and lakes with pre-existing populations. The evaluation will include a combination of OTC marking fingerlings, using genetic markers to assign parentage of egg- or fry-stocked fish, and evaluating angler utilization of Yellow Perch stocked in the spring as age-1 juveniles. Initial sampling results suggested that year-classes were produced in many of the stocked waters, with the winterkill lakes having the highest gill net catches. This study will continue through 2023.

Saugeye stockings from the past few years have begun to produce fisheries in the southeast, particularly in Lakes Goldsmith and Campbell. Evaluation of the success of these stockings is a bit complicated due to some prior and simultaneous Walleye stockings, so future evaluation may be warranted.

Central, SD, Region

Lake Sharpe WAE Tagging Study

As of January 10, 2020, angling exploitation is 13.8 % on Lake Sharpe for the 2019 field season. The 2019 field season ended with 4,009 walleyes and saugers receiving monel jaw tags, which brings the total to 11,536 since the project started in 2017. Additionally, 30 walleyes received Vemco V13 transmitters, making for 60 total transmitters in the system currently. Several transmitters were returned this summer due to harvest, so surgeries were conducted this fall to return transmitters to the system.

After the first year of preliminary walleye movement data, from June of 2018 to June of 2019, we can make a few general conclusions. The middle portion of the reservoir, or the transition zone from lotic to lentic, holds a majority of our tagged fish year-round. Overall, our data shows a majority of the fish utilize their time between West Bend and Polo Fields. The two highest concentrations are between Polo Fields to Antelope Island and De Grey to Cedar Creek. We anticipate variability in the movement patterns moving forward depending on variables such as flow rates and food availability.

SMB consumption of WAE in Lake Oahe Study

Evaluating consumption rates of stocked age-0 Walleye *Sanders vitreus* by Smallmouth Bass *Micropterus dolomieu* and adult Walleye in Lake Oahe

Emily E. Grausgruber[1], Michael J. Weber[1], and Mark Fincl[2]

Smallmouth Bass *Micropterus dolomieu* were introduced to the Missouri River reservoirs in the 1980s and have since become abundant, providing relatively new angling opportunities and economic growth. However, Walleye *Sander vitreus* anglers have expressed concerns regarding the potential effects of Smallmouth Bass on Walleye populations. Walleye are popular sportfish in South Dakota, but standardized South Dakota Game, Fish & Park (SDGFP) lake surveys the past decade have indicated declining populations in several Missouri River reservoirs. Concerns regarding what factors may be resulting in Walleye population decline has incentivized research evaluating post-stocking predation by Smallmouth Bass and adult Walleye. Thus, our objective is to evaluate predation of adult Smallmouth Bass and Walleye on wild and stocked age-0 Walleye in Lake Oahe through intensive diet analysis in two bays that were stocked with Walleye and one bay that was not stocked. Captured adult Walleye and Smallmouth Bass were marked with jaw tags in order to estimate population sizes within each bay and stomach contents were recovered via pulsed gastric lavage. This is a two-year project, with May to September 2019 being the first field season with age-0 Walleye stocked in Spring Creek and Okobojo and no stocking occurred in Cow Creek. Across bays, we collected and lavaged 1,146 Smallmouth Bass and 287 adult Walleye. Of the individuals lavaged, 81% of Smallmouth Bass and 72% of adult Walleye had stomachs containing at least one prey item. Age-0 Walleye were recovered from Smallmouth Bass stomachs for the first 11 days post-stocking, but never thereafter. Additionally, tissue samples were collected from Smallmouth Bass, adult Walleye, and a variety of prey species for stable isotope analysis. With Smallmouth Bass populations increasing on all four Missouri River reservoirs, this work will greatly enhance fishery managers understanding of interactions between Walleye and Smallmouth Bass. This is particularly important when considering discussions with Walleye anglers who believe Smallmouth Bass competition/predation is a major driver in Walleye recruitment. Moreover, with the limited space

and high demand for SDGFP hatchery products, this project also examines the impacts of stocking Walleye in the face of possible Smallmouth Bass and adult Walleye predation.

Western, SD, Region

Western Reservoir WAE Tagging Study

Starting in February 2020, South Dakota State University graduate student Cade Lyon, as well as fisheries biologists from the Pierre and Rapid City offices will conduct a walleye hooking mortality study. The study is looking at the effects of capture depth and water temperature on short term mortality of walleyes. Fish caught between 15 – 18 inches will be tagged with radio transmitters and mortality will be monitored for 120 hours post-release using active tracking. The purpose of this study is to assess the effectiveness of the 15 – 18 inch protected slot on Belle Fourche Reservoir in western South Dakota.

Following ice-off, Cade Lyon and Rapid City fisheries biologists will begin the second year of walleye jaw tagging efforts on three west river reservoirs. This April, approximately 1,000 fish will be tagged in Angostura, Belle Fourche, and Shadehill reservoirs. This extensive effort is looking to answer questions regarding walleye angling pressures and mortality. 2019 was the first tagging year and up-to-date angler exploitation has been estimated for each reservoir: Angostura, 32.6%; Shadehill, 18.4%; Belle Fourche, 15.2%.

WISCONSIN

2019 Wisconsin NCD Walleye Tech Committee Report

Submitted By Steve Gilbert

2020 Walleye Technical Committee Winter Meeting

2019 Wisconsin Report

1. **Wisconsin Walleye Management Plan Update**
   In 1997, after years of work involving a diverse group of interested parties, the first statewide walleye management plan was developed. This has guided our management of this species for the last twenty plus years in Wisconsin. At the direction of our administration our statewide walleye team will start the process of updating this document. They will also evaluate how well the agency addressed the issues and goals outlined in the original document. The updated document will guide our management of this species into the future.

2. **Wisconsin Walleye Initiative (WWI)**
   This program has been extended and become a permanent allocation in the state budget until specifically written out. This will make about 2 million dollars of general state funds available over the next two years to rear large (6”+) or purchase from private growers large (6”+) walleye fingerlings.

The state walleye team is continuing to evaluate the success of fall fingerling walleye stocked as part of the WWI. The team's decision was to study the effect of various stocking densities, and measuring success by two main management goals, listed in order of priority:

1. (Re)-establishing natural walleye reproduction
2. Establish and maintain fishable walleye populations

In each year, all lakes receiving fall fingerling walleye will be assigned to one of four treatment groups: 5, 10, 15 or 20 fall fingerlings per acre. A subset of 72 "sentinel lakes" was randomly chosen to be monitored annually through the duration of the project. The adaptive management component is intended to commence after three stocking cycles, with elimination of stocking from waters with no return and hopefully identifying an optimum stocking rate (or optimums for specific classes of lakes).

3. Hatchery Walleye Production

Due to the continued legislative funding of the WWI program a significant number of large walleye fingerlings ($\geq$ 6") were again produced in our state and private hatchery system in 2019. The state hatcheries also produced a significant number of small fingerling (1.2 to 2") walleye.

	Fry	Small	Large
2018	22,479,191	985,468	823,110
2019	13,542,589	1,633,218	779,458
2020	38,530,000	999,116	813,464

* 2020 totals are proposed production numbers

These numbers do not include fish purchased by private groups

4. Regulation Changes

There were no major walleye related fishing regulations put in place for the 2019 season.

5. Staff Issues

A newly elected governor in 2018 brought new administrative natural resource appointment in 2019. This included a new secretary for the Department of Natural Resources and a new Fish, Wildlife, and Parks division administrator.

Positions filled through open recruitment in 2019:

Central Office

Fisheries Management Section Chief
Fish Culture Veterinarian

Fisheries Supervisors

Hatchery Supervisor for the St. Croix and Osceola Facilities
Spooner Area Fisheries Supervisor
Black River Falls Operations Supervisor

Fisheries Biologist

The department filled a newly created fish culture biologist position. This individual will be stationed at the Wild Rose hatchery.

There was only one other biologist position filled in 2019 and that was for Vilas County and stationed in Woodruff. Due to retirements, promotions, transfers, and departures there are six current biologist vacancies that will hopefully be filled in 2020.

Fisheries Technician
We filled five fisheries technician positions around the state. One was in our hatchery program (Kettle Moraine Springs) and the others in fish management (Dodgeville, Poynette, Asylum Bay, Sturgeon Bay).

Application information for all state seasonal and permanent positions can be found on the Wisconsin state employment site www.wisc-jobs.

6. **Walleye Research**
Wisconsin DNR Office of Applied Science (Research)

- 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 less than desirable adult walleye densities, major improvements in walleye growth, declines in age at maturity, and no significant influence on walleye recruitment. This study is in preparation for publication with the Great Lakes Indian Fish and Wildlife Commission as collaborators.
- 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 of the Wisconsin Cooperative Fishery Research Unit at UWSP to genetically link age-0 and age-1 walleye with individual parental walleyes. 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 UWSP graduate student Levi Simmons will be conducting the walleye pedigree analysis for both lakes for his M.S. thesis.
- 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.
- 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 and 2019 and monitoring of the fish community and walleye recruitment responses are ongoing.

- An evaluation of the characteristics of the tribal and angling walleye fisheries was conducted by Wisconsin DNR researchers. The length distributions of walleye harvested in both fishery types were similar. Anglers harvested more walleye annually on average; however, the tribal spear fishery was much more efficient. Hyperstability in catch and harvest rates were identified in both fisheries suggesting that catch rates may not decline until a walleye population is severely depleted. This research was published in the *North American Journal of Fisheries Management* in 2018 by J.T. Mrnak et al.
- An evaluation of live versus artificial bait influences on walleye angler effort and catch rates was conducted on Escanaba Lake, Wisconsin during 1993-2015. Angler effort (hours/trip), catch rates, and catchability was higher for walleye anglers using live bait. Instead of complete fishery closure during walleye population rehabilitation efforts, live bait restrictions could be used to decrease angler effort and walleye catch rates. This research was published in *Fisheries Research* in 2019 by C.T. Bailey et al.
- In collaboration with WDNR fisheries researchers and biologists, UW-Madison Center for Limnology scientists tested for production overharvest in walleye populations of the Ceded Territory of Wisconsin over time. Production overharvest occurs when harvest exceeds production in that year. The research suggested that about 40% of the walleye populations in the Ceded Territory have been production overharvested, which is about 10 times greater than current numerical estimates of overharvest. This research was published in the *Proceedings of the National Academy of Sciences* in 2019 by H.S. Embke et al.

- Walleye comparative recruitment study. Beginning in summer 2017, a 3-5 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 2019 we have 3 years of data covering 29 lakes (17 declining NR and 12 stable NR). Preliminary 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 evaluate temporal trends in riparian habitat of study lakes. As part of this project and age-1 index of abundance was generated to equate fall electrofishing catch to a relative density estimate. A manuscript describing the index is in review at Fisheries Management and Ecology.

- Maternal effects and walleye recruitment projects are ongoing. In 2019 Feiner, Shaw & Sass published an article in CJFAS "Influences of female body condition on recruitment success of walleye in Wisconsin lakes". Feiner et al. found that condition (relative weight) had a positive effect on maturation for small females (15 to < 18"), and fecundity in intermediate sized females (18 to < 22"). Among and within populations, condition increased as adult density declined and condition increased with increasing growing

degree days. Recruitment was positively related to variation in condition of large females (>= 22").

Other related studies include annual egg samples collected on Escanaba and Sanford lakes to evaluate the influence of female walleye length and condition on egg size. Future projects include evaluation of female walleye length and condition on hatching success and larval size at hatch.

University of Wisconsin-Stevens Point Research

- Ongoing assessment of walleye movements and fishery contributions in Green Bay. Acoustic transmitters implanted into 339 walleyes during fall 2017-spring 2018 and movements monitored with > 150 stationary acoustic receivers. Dan Dembkowski is presenting initial results at the Midwest Fish and Wildlife Conference in Springfield (Tuesday at 9:00 AM).
- Completed assessment of larval walleye diets in northern Wisconsin lakes with a focus on lakes with differing recruitment histories (sustained recruitment vs. declining recruitment). Poster will be presented at the Midwest (#FM-04).
- Completed assessment of improvements in precision and accuracy of walleye age estimates with minimal training. Results suggest that simple and low-cost age estimation training can substantially increase precision and accuracy of age estimates among a large group of readers with varying levels of experience. Paper published in NAJFM.
- Ongoing evaluation of the response of walleye recruitment to large-scale centrarchid removals in a northern Wisconsin lake. Collaborative project with WDNR and UW-Madison Center for Limnology. Giancarlo Coppola is presenting project updates on Tuesday at 2:00 PM.
- Completed study of trophic interactions among walleye, yellow perch, and lake whitefish and the influence of walleye predation on perch and whitefish recruitment in Green Bay. Lucas Koenig will present his findings at the Midwest Fish and Wildlife Conference (Tuesday at 11:00 AM).

No reports submitted from Indiana, Mid Canada, Ohio, or Ontario