American Fisheries Society-North Central District-Esocid Technical Committee Report-2022 ETC Chair-Jordan Weeks (Wisconsin DNR)

Dakota Chapter Report-Brian Blackwell (SDGFP)

Angler Use of Trophy Northern Pike in Lake Oahe, ND

Paul Bailey (presenter), Justen Barstad, Dave Fryda, and Russ Kinzler, North Dakota Game and Fish Department

Lake Oahe has long supported one of North Dakota's premier trophy (≥ 1 meter in length) northern pike fisheries. However, information on angler use and guidance as to the level of exploitation that could be supported while maintaining the present quality of this fishery was lacking. The North Dakota Game and Fish Department (NDGF) conducted a tagging study to estimate angler exploitation of trophy northern pike in the North Dakota portion of Lake Oahe and applied guidance from previous trophy *esocid* research to estimate the level of exploitation that could be sustainably supported. We observed a 7.1% annual exploitation rate (90% CI: 4.9-9.9%) of trophy northern pike in Lake Oahe and estimated that an annual exploitation rate $\leq 20.9\%$ is likely to maintain the present quality of this fishery. Together, this information indicates that the NDGF's current harvest regulations are compatible with the long-term sustainability of trophy northern pike fishing in Lake Oahe.



Iowa Update-Jonathan Meerbeek (Iowa DNR)

Muskellunge Stocking, Tagging, and Population Dynamics (Contact: Jonathan Meerbeek jonathan.meerbeek@dnr.jowa.gov) - Thirteen lakes and impoundments are managed as Muskellunge fisheries in Iowa and populations are maintained via stocking spring-stocked, pellet-started minnow finished yearlings. In 2021, 1,564 yearling Muskellunge (mean TL ranged from 12.8 in to 14.2 in among systems) were stocked in 4 natural lakes. In lakes where Muskellunge are used as broodstock, populations are monitored via annual spring gillnetting and population metrics are estimated using the Jolly-Seber model. Sampling in 2021 was limited to the Iowa Great Lakes, where 188 Muskellunge (66 females, 117 males, 5 immature/unknown) were sampled and adult Muskellunge (\geq 30 inches) population estimates were 287 in Spirit Lake and 739 in the Okoboji lake. All yearling Muskellunge stocked into Iowa's natural lakes are tagged via PIT tags prior to stocking (since 2011). To date, 1,201 yearling Muskellunge have been recaptured and initial analyses indicate that size (TL) at stocking is an important variable influencing survival to age-2+. However, we have observed that survival rates vary considerably among lakes. More specifically, survival is much higher in general in lakes where large populations of top-level predators are absent (i.e., Clear Lake; Figure 1).



Figure 1. Known yearling Muskellunge survival to age-2+ by length group (0.5 in) in Clear, Spirit, East Okoboji, West Okoboji, and Black Hawk lakes.

Yearling Muskellunge Survival Study (Principle Investigator: Jonathan Meerbeek <u>jonathan.meerbeek@dnr.iowa.gov</u>) – Year five of a stocked yearling Muskellunge telemetry project was completed in 2020. The first two years of the study found that the

size of fish stocked was most important variable influencing yearling Muskellunge survival. Based off logistic regression models, a 13.0" Muskellunge had a 70% chance of survival to 100 day, whereas, a 14.0" Muskellunge had a 90% chance of survival. In 2018, 2019, and 2020 additional efforts were made to increase stocked yearling Muskellunge to TLs \geq 13.0 inches. More specifically, fish were sorted by size in May and fish not exceeding the minimum length of 13.0 in (or 200 g) were reared for an additional 30-40 days. On average, yearling Muskellunge grew ~ 1.0 in and 40-60g during the grow-out period. Prior to stocking each year, a subsample of grow-out yearling Muskellunge were affixed with radio telemetry tags. Of the 52 fish tagged between 2018-2020, 34 survived (65%) \geq 108 d post-stocking (50% survival in 2020). Also in 2020, a subsample of large (>13.0 in; direct-large) yearling Muskellunge were affixed with radio tags and stocked in May and only 6 of 17 (35%) survived 100+ days. Great Blue Heron density and feeding efficiency in 2020 was largely responsible for the poor performance of both direct-large and grow-out yearling Muskellunge (12 of the 20 known mortalities). However, for both cohorts, Great Blue Heron predation occurred only within the first 2 weeks post-stocking when fish remained near the Hales Slough boat ramp where Great Blue Herons have learned to feed. In addition, water transparency during May-June was exceptional (\geq 2.2) and likely influenced both Great Blue Heron and fish predators feeding efficiency. In 2021, we attempted to reduce avian predation of stocked yearling Muskellunge by growing out fish until late June and then stocking them from a boat, slowly navigating the littoral periphery of the lake while periodically releasing yearling Muskellunge. Survival using this technique was 71% through 60 days post-stocking and no fish were lost to avian predation. Of the four fish that died, all were < 13.5" and were the four smallest radio tagged fish in 2021.

Effectiveness of an electric barrier to reduce emigration of Walleye and Muskellunge in Iowa's natural lakes (Principle Investigator: Jonathan Meerbeek

jonathan.meerbeek@dnr.iowa.gov) - Downstream movement of adult Muskellunge in an interconnected chain of lakes has been extensively documented in Iowa via the states broodstock collection program and extensive PIT tagging database. In some years, approximately 50% of the adult Muskellunge population has moved from Spirit Lake downstream to the Okoboji chain via a spillway that connects the two waterbodies. Since the spillway acts as a fish barrier to fish migration upstream during most of the year, Muskellunge populations in Spirit Lake have suffered and drastic population imbalances have been observed. A similar problem exists at the outlet structure of the interconnected system and Muskellunge loss to the river has commonly occurred. However, an electric fish barrier was installed in 2013 to prevent Asian Carp from entering the lake system and as a side-benefit, hopefully reduce Muskellunge loss. Since July 2017, the area directly below the outlet dam has been sampled via electrofishing to collect Muskellunge and determine if escapement has occurred post-barrier installation via PIT tag information. In 2019, 97 Muskellunge have been collected below the barrier during 19 electrofishing events. Collectively, 254 Muskellunge (25.0-47.0 in) have been collected below the electric fish barrier and returned to the lake. Many of these fish had moved into the river post-electric barrier installation. In summer 2019, a low-pulse (0.5 volts/in) electric fish electrode was installed directly above the electric fish barrier in attempt to prevent downstream movement of Muskellunge and Walleye. The effectiveness of the barrier was planned to be evaluated in 2020-2021; however, water levels were not conducive to perform the evaluation. The evaluation will be conducted in 2022 if water levels remain high throughout the open water period.

Northern Pike Propagation and Stocking (Fairport Hatchery Manager and Mississippi River Management Station: Andy Fowler <u>andy.fowler@dnr.iowa.gov</u>; - Northern pike adults were captured from the Mississippi River using fyke nets in March and either stripped or stocked in hatchery ponds where they were allowed to spawn naturally. The fry production was 185,000 which were bagged and stocked into Middle Sabula and Green Island on April 5. On May 20 fingerlings were sampled and measured showing successful spawning had occurred in the pond. The pond yielded 19,089 fingerlings that were stocked in the Mississippi River. Another 32 advanced fingerlings were produced via a Koi pond and were also stocked in the Mississippi River.

Big Creek/Brushy Creek Muskellunge Emigration Study (Principle Investigators: Michael Weber mjw@iastate.edu), Phase two of the Big Creek and Brushy Creek reservoir escapement project began in 2021, and two new graduate students were hired (Madeline Lewis, PhD student, Thomas Miles, MS student). Escapement of Muskellunge from both lakes is being monitored post-barrier installation using PIT-antennas. During 2016-2019, no telemetry tagged Muskellunge escaped Big Creek where a physical barrier existed whereas 18-54% escapement was observed at Brushy Creek without a barrier. IDNR night electrofishing occurred in early November 2021 and lasted one night at each lake. At Big Creek, three Muskellunge were collected and 11 Muskellunge were collected at Brushy Creek. Fifteen acoustic telemetry tags were purchased per lake to further evaluate movement and behavior of Muskellunge. Nine acoustic telemetry receivers were set on Big Creek and 10 receivers were set on Brushy Creek. On Big Creek, we tagged a total of six Muskellunge with V16TP sensor tags which indicate depth and temperature of the fish and on Brushy Creek, we tagged a total of nine Muskellunge with V16 tags. The remaining telemetry tags (Big Creek: V16TP [n=4], V16 [n=5]; Brushy Creek: V16 [n=6]) will be deployed in spring 2022.

Kansas update-Micah Waters (District Fisheries Biologist-Kansas Department of Wildlife, Parks, and Tourism)

There are only two bodies of water in the state of Kansas with populations of Northern Pike *Esox Lucius*. Lyons State Fishing Lake and Kingman State Fishing Lake. The population at Lyons SFL currently has a very low abundance. There has been no evidence of natural recruitment and there have only been a few Pike sampled at Lyons SFL in the last few years.

Kingman State Fishing Lake is a shallow impoundment that is about 30% covered with emergent and submerged vegetation. There is a spring in the lake which provides thermal refuge and allows for the survival of Northern Pike during the summer. The lake was renovated in 2012 to remove White Perch *Morone americana*, Gizzard Shad *Dorosoma cepedianum*, and Common Carp *Cyprinus carpio*. Prior to renovations, the Northern Pike population was self-sustaining with natural recruitment being documented. However, since the renovation, there has been no natural recruitment. Increased turbidity and decreasing vegetation have led to a decline in Relative abundance of Northern Pike. It is unlikely that a population will become self-sustaining if current habitat conditions remain. Fingerling Pike were not received in 2021. Stockings of Pike will likely be needed in order to maintain the populations. Another renovation may also be necessary in the future to remove Common Carp and Gizzard Shad populations as well as improve habitat to support a population of Northern Pike.

Michigan Report-Addie Dutton (MI DNR)

In 2021, Michigan had its second coolwater fish hatchery up and running for the first production cycle. The new facility at Thompson State Fish Hatchery reared Walleye and Great Lakes strain Muskellunge. The facility is state of the art with a solar pond, two oneacre ponds, and four half-acre ponds. The facility is located in between Lake Michigan and Indian Lake, a larger inland waterbody. Due to the proximity to these waterbodies, the hatchery is outfitted to protect the fish from avian predators including cormorants, ducks, and raptors. Avian predation netting is around each pond and also across the top of all ponds. The facility raised Muskellunge in the four half-acre ponds in 2021. Thompson State Fish Hatchery raised a total of 20,102 Great Lakes Strain Muskellunge in their inaugural year. This was a success with four of the five ponds having a rate of return greater than 65%. The fish were on average 9.2 inches in length and were stocked in 11 different locations across the state. All fish were hand counted and loaded onto the stocking trucks and technicians reported highly active fish after stocking. The success of Thompson is exciting for Michigan anglers as the new hatchery will most likely double to current capacity for Muskellunge rearing in the state.

The Great Lakes Muskellunge inland broodstock program is still slow getting off the ground. The state currently has two lakes: Thornapple and Hudson that are receiving stockings specifically for the creation of an inland source. Thornapple Lake was surveyed in spring and fall of 2021. No Great Lakes strain fish were captured in the spring, but seven were captured in the fall. We hope to increase stocking rates and use adaptive management techniques to assess if stocking fish upstream in the Thornapple River will lead to increased survival and capture probability of fish in Thornapple Lake. Lake Hudson is showing promise as a broodstock lake, with anglers catching many small (<30 inches) fish fairly regularly.

2021 marked the eight year of mandatory registration for anglers harvesting Muskellunge. The limit is one Muskellunge per angler per year. As of January 14th, 14 Muskellunge have been harvested for this fishing season (April 1-March 31). In comparison, there were 46 Muskellunge harvested during the 2020-2021 fishing season. Michigan fishing regulations have three options for Northern Pike. The statewide (2 daily bag limit, 24 inch minimum), the liberalized (5 daily bag limit, no minimum, only 1 fish over 24 inches), and the protected slot (2 daily bag limit, no harvest between 24-34 inches). We have recently began surveying some lakes that have had the liberalized or protected slot regulation. One lake in urban SW Michigan indicated that size structure and age structure improved since the protected slot limit was put in place for Northern Pike. Anglers are supportive of the new regulation and conservation officers have noted that people seem generally in favor of the regulation.





Aerial views of Thompson State Fish Hatchery's new coolwater facility. Top photo shows Lake Michigan in the background. Bottom photo shows Indian Lake in the background.

Minnesota Report-Mike Habrat (MNDNR)

On the Pike front:

The Pike technical committee co-chairs are in the early stages of compiling feedback from area offices regarding our Northern Pike Toolbox Regulations, in addition to starting to dig into the early data from the statewide zone regulations. Also an update on the 100 Lake Cap Statute....now that Nov. 1, 2021 has come and gone, a portion of the statute has sunset and we gained the ability to add special regulations to new or different lakes, but we are still restricted by the 100 lake limit. New northern pike regulations will be treated as experimental regardless of whether they come from the Toolbox, requiring the use of a 10-year evaluation period. There is currently plenty of room under the cap to propose special/experimental pike regulations.

On the Muskie front:

Statewide Muskie Production

• The plan for fall 2021 was to stock 32,943 muskies into 46 lakes and one river. This quota included 5,828 muskies to be stocked as make-up toward stocking that did not occur in fall 2020. Ultimately we were able to stock

25,878 fingerlings and 397 adults. We consider adults the equivalent of four fall fingerlings. Ten lakes did not get any fish and seven lakes did not get full quotas.

- We <u>would have likely</u> met our 2021 quota if we didn't prioritize stocking select "make-up" lakes from 2020.
- Three lakes in the metro were stocked with 1,000 tiger muskies in fall 2021. All tiger muskies stocked in 2021 were purchased from private fish farms.
- We did not purchase any pure strain muskies from the private sector this year.
- The egg take was very drawn out this year and split between Rebecca and Leech Lakes.
- Obtaining muskie forage (fathead minnows) continues to be a challenge. Costs have increased and the number of bait dealers willing to trap minnows for State purchase has decreased.

DNR Muskie Research

• Muskie Genetics - Dr. Loren Miller

The International Falls Area sampled Little Shoepack Lake, in Voyageurs National Park, for the first time in a couple decades. The distinctive Shoepack Lake population had the lowest genetic diversity of all Minnesota populations, but Little Shoepack is even slightly lower, indicating infrequent movement between the lakes. The low diversity in these populations raises concerns about possible inbreeding, yet they have persisted all this time. Dumbbell Lake, near Finland, was stocked from 1971 to 1995 with three strains and now has mostly Shoepack and Wisconsin ancestry, meaning that the population is persisting through natural reproduction by these strains. Only a little Leech ancestry remains.

• Niche overlap and diets of Muskellunge and other piscivores - Contact Brian Herwig

In early November, we wrapped up our third year of fieldwork for a collaborative study among MN DNR, University of St. Thomas, and Bemidji State University that is gathering data on the diets of Muskellunge, Walleye, Northern Pike and Largemouth Bass in a set of 20 Minnesota lakes with contrasting prey fish communities. This year's lakes included Pelican, Bemidji, Shamineau, Star, and Deer lakes. A final year of fieldwork is planned in 2022, with North Star, Cass, Little Boy, and Fox on our sampling list. Diets have been sampled with two methods throughout this study: traditional stomach content analysis and stable isotope analysis. In a nutshell, traditional stomach content analysis involves a technique called gastric lavage where water is used to flush stomach contents from the fish. For stable isotopes, diets are inferred indirectly as fish stable isotope signatures reflect those of their prey in a "you are what you eat" fashion. Resulting data are being used to quantify the feeding niches of Muskellunge, Walleye, Northern Pike, and Largemouth Bass. We are also comparing patterns in lakes with and without Cisco crossed with lakes with and without Muskellunge populations present. Our results are being combined with other data to assess the

potential influences of these four piscivore species on various prey and game fishes. Data analyses and conclusions are still preliminary, but for the lakes sampled in 2019 and 2020 (or earlier) some of the patterns we're seeing so far for Muskellunge and some of the other top predator fish include:

Based on stomach content analysis -

- In lakes with both Muskellunge and Cisco present, Yellow Perch were the dominant prey species for Muskellunge. Other important prey categories include Largemouth Bass, White Sucker, and unidentifiable fish. Other prey items included bullhead and aquatic invertebrates (2-3% each). Only 1 Cisco has been found in the Muskellunge diets so far.
- In lakes without Cisco present, Northern Pike were the most important Muskellunge forage, followed by sunfishes, Largemouth Bass, Black Crappie, and bullheads. Additionally, many Muskellunge diets in this lake category contained unidentifiable fish.
- Yellow Perch and various Centrarchids (e.g., sunfish, crappie) were important prey items across all lakes for Muskellunge, Northern Pike, and Walleye, while crayfish and other aquatic invertebrates were critical for Largemouth Bass.
- An index of how much diets overlap indicates that Muskellunge have low levels of dietary overlap with other predators, while Northern Pike and Walleye have relatively high levels of dietary overlap.
- Additionally, diet overlap tended to be lower among all species when Cisco were present, even though direct predation on Cisco was rarely observed.

Based on stable isotope analysis -

- Largemouth Bass and Northern Pike have high isotope niche overlap (thus potentially high dietary overlap) in most lakes.
- Muskellunge and Northern Pike and Muskellunge and Largemouth Bass tend to have lowest overlaps.
- Walleye occupies a higher trophic position and is more pelagic than Largemouth Bass and Northern Pike, and has greatest potential for overlap with Muskellunge, but we still don't see much.

Nebraska Report-Keith Kupal (Nebraska Game and Parks Commission)

The following report is being submitted to the Esocid Technical Committee meeting in February 2022 at the Midwest Fish and Wildlife Conference. Nebraska has limited use of esocids within our systems. We are managing to stock muskie, tiger muskie, and northern pike in the requested systems and anticipate trying to provide each species of fish every three years from the hatchery system. Space to culture esocids to a desirable size and the expense involved with raising them to this size are limiting factors for increased production and stocking. Many waters seem unable to successfully recruit these species. Thus, a statewide 40 inch minimum is in effect for muskie and many stocked waters have a 30" minimum on northern pike. A 50" minimum length regulation has been implemented on Merritt Reservoir.

With an interest in creating a potential muskellunge destination fisheries and the observed fast growth rate and potential from the Sandhills region of Nebraska, a muskellunge project has been proposed and funded with a Hugh Becker based grant. This project would focus on getting accurate age-growth analysis of Muskellunge from both Merritt Reservoir and Cottonwood Steverson Lake. Use of PIT tags in newly stocked individuals would allow for improved age and growth information over time, as well as determination of natural recruitment. This project was set to begin in 2020 but spawn collection activities were suspended with concerns of COVID virus protocols. We were able to collect over 50 muskie during walleye spawning activities at Merritt Reservoir as well as more than 50 at Cottonwood-Steverson lake in two days of electrofishing. Pelvic fins were collected and are being processed to age by two biologists. The collected data will provide age-growth data specific to each fishery and assist us with better management regulations of these populations.

Our hatchery system has been asked to produce muskie, tiger muskie and northern pike next year and space available will try to fulfill those requests. The muskie and northern pikes will be used to supplement existing Nebraska lakes, while the tiger muskies are primarily to fulfill trade obligations with western states.

Ohio Report-Curtis Wagner (ODNR)

Ohio DNR continues to collect angler reports in MAL, netting Leesville for 100% of our brood production, still stocking 9 reservoirs at 1/acre, not doing any more stocked cohorts of PIT tagged fish but rather annually collected encounter data from 4 research reservoirs via spillway escapement antennas, in-reservoir netting captures, and angler tag reports.

West Virginia Report-Jeff L. Hansbarger (WVDNR)

WVDNR staff concluded a 'hot water' delayed mortality project in conjunction with several state agencies and universities in the fall of 2021. Grad students are currently analyzing data and planning dates for defense, etc. WVDNR hatchery production for Muskellunge was excellent in 2021 after not being able to meet quotas in past years due to various issues. All waters slated to be stocked received their allotted fingerlings. Muskellunge anglers continue to do well on WV waters. A new state length record Muskellunge (54.0625") was caught and released by Chase Gibson from Burnsville Lake WV in 2021. Numerous fishing club banquets will be held in the next few weeks in WV allowing anglers to get out and see old friends/meet new ones, purchase lures, and discuss new techniques. A few such as the Muskies Inc. Chapter 9 annual banquet (2/12/2022) will have WVDNR staff available to answer questions and discuss recent research/related work.

Wisconsin Report-Jordan Weeks (WIDNR)

1-Wisconsin is currently drafting Administrative Code regarding Genetic Management Units and stocking protocols for Muskellunge and Northern Pike (and for all other stocked species). These rules should be finalized by July 2022.

2-Wisconsin DNR plans to ask an advisory question during our annual public input meeting regarding Northern Zone muskellunge season structure.

The current Southern Zone (inland waters south of Highway 10/Waldo Blvd) season runs from the first Saturday in May to Dec. 31 (ice angling allowed), and the Northern Zone (inland waters north of Highway 10, Waldo Blvd—excluding WI/MN boundary waters) season runs from the Saturday prior to Memorial Day to Dec. 31 (on open water only-ice angling prohibited). The proposed season structure is an open harvest season running from the first Saturday in May to December 31 on open water only, which would apply statewide and would eliminate the need for muskellunge zones.

This proposal would apply a uniform season structure for muskellunge in Wisconsin. It would not change the daily bag limit of 1 fish at least 40" in total length. It would also eliminate the need for muskellunge zones and would simplify regulations. It would include an "open water only" component which would change the southern zone rule to no longer allow ice angling for muskellunge prior to Dec 31. A citizen resolution was introduced in Vilas and Oneida Counites in 2019 and a Conservation Congress advisory question to change the season to the first Saturday in May with May being catch and release for muskellunge in the Northern Zone was supported by spring hearing attendees in 2020.

The management goal is to simplify regulations and to provide additional angling opportunity for muskellunge. Under the current zonal system there are two separate muskellunge harvest openers. In the South Zone, anglers can legally fish muskellunge beginning the first Saturday in May, while in the North Zone they cannot legally target muskellunge until the Saturday before Memorial Day. This system has been in place for over 50 years. Common reasoning for the current rule includes protection of fish during the spawn and fear of illegal capture via foul hooking. However, there is a lack of published research available to support these reasons. Furthermore, studies like Flink et. al. 2021 (*Fisheries*) indicate that angling for naturally reproducing spawning pike (a very closely related species) had no adverse effects at a population level.

Wisconsin also currently has a year-round catch-and-release season for bass. This season allows anglers to target bass statewide all year long. At times anglers may claim to be fishing for bass while attempting to catch and release muskellunge, walleye, or northern pike during traditionally closed seasons. Opening the muskellunge season statewide at the same time as other gamefish seasons leads to simplified regulations and more angling opportunity.

1. Do you favor implementing a standard season			
structure statewide (including boundary waters			
and the Great Lakes) for muskellunge with	1.	No	No
opening day of the harvest season beginning the	Yes	NO	opinion
first Saturday in May and extending to December			
31 in open water only?			

3-Wisconsin Department of Natural Resources Hot Water Angling Summary-DRAFT Preliminary Results

To provide fisheries managers with data to proactively and sustainably manage muskellunge populations the Wisconsin Department of Natural Resources (WDNR) conducted an experiment to address questions related to catch-and-release mortality of muskellunge during the warm water period. This study was one part of a larger mortality study being performed by researchers from West Virginia University, Costal Carolina University, Virginia Department of Game and Inland Fisheries, West Virginia Division of Wildlife, and North Carolina Wildlife Resources Commission. In March and April 2021, twenty wild Muskellunge were captured by WDNR and transported to an experimental hatchery pond at the Richard Bong Recreation Area in Kansasville, Wisconsin. WDNR intended to angle 50% of fish after an acclimation period. The remaining fish were used as controls. WDNR monitored three levels of mortality: immediate, short-term (72 h), and long-term (2 weeks), and investigated the effects of angling (angled vs. control), water temperature (<80 F and >80 F) fight duration, and fish length on mortality. Because fish from different waters may have unique adaptations to thermal stress, we will account for source location of fish in all analyses. At the end of the experimental period, ponds were drained to verify survival or mortality of remaining fish.

Results from this study will provide managers with information to make data-driven decisions about possible restrictions on angling for Muskellunge during the summer or warm water periods. This project will also result in the training of an MS student and subsequent thesis (WVU). Results from this study will be presented at the annual meeting of American Fisheries Society and to multiple muskellunge angling clubs that have helped to develop this project. We will work with Muskies Inc. to write an article for their monthly member magazine and anticipate submitting at least one manuscript for publication in a peer-reviewed fisheries journal.

Before May 1, 2021, twenty muskellunge ranging in size from 32-42" inches were transferred into the 0.6 acre study pond. Throughout the study WDNR monitored the fish daily (M-F) and measured water temperature hourly at various depths and determined water chemistry periodically. Once water temperatures approached 75 F we coordinated angling events to capture 5 muskellunge.

On Friday June 4, 2021, Wisconsin DNR Staff performed a test run and captured 3 fish. All fish were caught using Lake X topwaters. Angling took place from 11am to noon, but actual fishing time was much less (~15 minutes). Fish were hooked and landed

using a large muskie net. Once captured, each fish was identified via PIT tag. Once identification was complete, each fish was held out of the water for 30 seconds to simulate a photo. After the 30 second holding period fish were immediately released. All fish were upright and swam off with no apparent ill effects. Surface water temperature was 75 F.

On Saturday WIDNR staff hosted several youth from a local muskie club (6). Our goal was to capture the remaining 2 muskellunge to reach our target number (5). I am happy to report that we were able to allow 2 young anglers to capture their very first muskellunge! A total of 3 fish were caught. 2 new individuals and 1 recapture from the previous day. All fish were upright and swam off with no apparent ill effects, however the recaptured muskellunge lingered near shore in sight for 15 minutes after capture. Several other non-angled muskellunge were observed swimming in the pond. Surface water temperature was 75F.

Fish captured (6/4/21):

1-968000010989959(PIT Tag number)-32.9" (unknown gender), origin-WI R @PDS dam, Lake X Fatbastard

2-968000010928092-39.8" female, origin-Twin Valley Lake, Lake X Lil' Basstard

3-968000010926668-36" male, origin-Peewaukee Lake, Lake X Dr. Evil

Fish captured (6/5/21):

4-Addie Ellis-968000010928092 (recap from day 1)-39.8" female, origin Twin Valley Lake, Lake X Dr. Evil

5-Chase Mirek-968000010926807-37.9" male, origin-Pewaukee Lake, Spinnerbait

6-Callen Mirek-989001005542884-36.9" male, origin-Lake Waubesa, Tackle Industries Oskie Glider

WIDNR staff monitored pond water temperature daily to capture the remaining treatment fish (5) in the upper temperature window (80+ Degrees F). 13 separate angling events with 2-3 anglers per event were performed in July and August. Three muskellunge were captured during this time period. On July 7, fish number 968000010928092 (39.8" female-caught twice previously) was captured at 82 degrees F surface temperature. On July 27, fish number 956000008969875 (33.2" male) was captured when surface water temperatures were 80.4 F and on August 13, fish number 982091063973903 (39.2" female) was caught when surface temps were 76 degrees F.

In summary, WDNR was successful capturing 6 treatment fish in the lower temperature window and saw zero immediate, short-term (72 h), and long-term (2 weeks), mortality with these fish. However, on July 2, 2021 we found a mortality (41" Female from

Pewaukee Lake). This fish had not been caught via angling. On 7/5/2021, exactly one month after it had been caught via hook and line, a 37.9" male (968000010926807) was found dead. At this time there was significant bacterial infection that may have been related to angling, however, WDNR cannot confirm this. Fish number 968000010928092, a 39.8" female, was caught three separate times during the study with no mortality. WDNR staff did observe 3 additional mortalities that were not related to angling (38.5" female on July 6, 35" male on July 16, and 36.8" female on Aug 2, 2021). These fish did not show signs of angling trauma and had not been caught prior.

Researchers had difficulty catching fish when water temps were over 80 degrees despite significant angling (~14 hours of effort). Two study fish were captured when water temperatures exceeded 80.0 F (33.2" male and 39.8" female that had been caught twice previously). Those fish did not experience mortality through September 15, 2021.

Twice during the study period, forage fish were delivered to feed the muskellunge (June and July). Each shipment consisted of 100+ white suckers (8-12" in length) donated by Gollon's Fish Farm in Dodgeville, WI. Many of these forage fish remained throughout the study period and were observed when the pond was drained.

Seven individual muskellunge were successfully angled during the study. Two fish were angled when water temperatures exceeded 80 F. Of those, 1 fish was caught 3 times, including once when the water temperature was 82 F. This fish did not die during the study period. Only one angled fish died. It was initially caught on June 5 (73 F) and was found freshly dead on July 5 (~80 F). According to the study parameters this fish qualifies as a long-term mortality (< 2 weeks) but cannot necessarily be attributed to angling. Five non-angled fish died during the study period. Source of mortality is not known at this time and is under investigation.

WDNR recovered all but one fish from the pond. The missing fish had not been caught angling and may have been a non-angling mortality. WDNR is currently working with study partners (West Virginia University, Costal Carolina University, Virginia Department of Game and Inland Fisheries, West Virginia Division of Wildlife, and North Carolina Wildlife Resources Commission) to analyze the data from our study and the other pond studies that were occurring concurrently.

A final research publication will be available once data analysis is complete (timeline is unknown at this time).





4-UW-Stevens Point Musky Research

Temporal stability of adult muskellunge abundance in northern Wisconsin lakes

Safe harvest levels for mixed muskellunge fisheries in the Ceded Territory of northern Wisconsin are based on estimates of adult abundance obtained from mark-recapture surveys conducted over a two-year period in a Lincoln-Peterson framework. Abundance estimates are considered valid for up to two years after the initial marking period. However, muskellunge typically have low rates of population turnover, suggesting more stability in population abundance and that estimates ≥ 2 years old may have utility in setting harvest quotas. We estimated annual adult muskellunge abundance in six northern Wisconsin lakes during 2014-2020 and used extant estimates from an additional 23 lakes to evaluate interannual variation in abundance over periods of 1-10 years. Using the current approach of estimating abundance, lake-specific estimates varied substantially but due to high amounts of uncertainty around individual estimates, often did not differ significantly among years. Although the lack of statistical differences in abundance estimates among years suggests a single estimate could be used to set harvest levels for several consecutive years, observed interannual variation in abundance could be meaningful from biological and management perspectives given that mean between-year differences in abundance estimates ranged from 31% (for estimates made 1 year apart) to 143% (for estimates made 10 years apart) and potential exploitation that could result from harvest quotas set directly from past abundance estimates generally exceeded the maximum allowable rate of 27%. Safety factors were generated to account for observed interannual variation in adult abundance using ratios of past-to-current abundance estimates at time lags of 1-10 yr. When applied to previous abundance estimates, safety factors reduced the likelihood of harvest exceeding 27% to less than 1-in-40 occurrences, which aligns with current harvest management policy and suggests that previous abundance estimates can be used to define current safe harvest levels but only when integrated with safety factors. Jolly-Seber abundance estimates generated from encounter histories of PIT-tagged muskellunge were less temporally variable (mean CV = 15.8%) than abundance estimates generated using the current approach (mean CV = 32.5%). Observed interannual variation associated with the current approach of estimating abundance may not necessarily reflect actual interannual variation in adult abundance and may instead be related to variation associated with sampling (e.g., spring weather events, warming rates, etc. that can substantially influence mark and recapture samples). Use of Jolly-Seber models and cumulative encounter histories of PIT-tagged individuals likely produces estimates more reflective of actual abundance and minimizes variation within and among estimates but may be challenging to integrate into the harvest management policy given needs for intensive sampling over several consecutive years at individual lakes.

Contact Dan Dembkowski (<u>dan.dembkowski@uwsp.edu</u>) with questions. A pre-recorded presentation on this project from the 2020 Wisconsin Chapter AFS Meeting is available at: <u>https://vimeo.com/wiscosinafs</u>.

Relative effectiveness of D-frame dip nets, quatrefoil light traps, and towed ichthyoplankton nets for larval muskellunge

Muskellunge are a large predatory game fish whose association with shallow, complex habitats is well-documented, particularly during early life stages. Despite this association, relatively little guidance exists regarding effective sampling of muskellunge larvae and previous efforts to sample larval muskellunge have been met with limited success. Therefore, our objective was to determine the relative effectiveness of three sampling gears for capturing naturally produced muskellunge larvae. Larvae were sampled during 2019 and 2020 at known muskellunge spawning locations in Snipe Lake, Wisconsin, with D-frame dip nets (1000 μ m mesh), quatrefoil light traps, and towed ichthyoplankton nets ((1000 μ m mesh). Sixty larval muskellunge were captured across all gears, and catches in D-frame dip nets comprised nearly 87% (52 of 60) of the total catch. Furthermore, D-frame dip nets captured the broadest size range of larval muskellunge (TL range = 14-33 mm). Greater effectiveness of D-frame dip nets in comparison with other gears is likely related to their ability to be used in and around structurally complex habitats without fouling or clogging. Our results suggest that D-frame dip nets should be considered as a cost- and time-effective tool for targeting larval muskellunge in complex habitats. Paper published in NAJFM:

Krebs, J.E., E.J. Brandt, D.J. Dembkowski, and D.A. Isermann. 2021. Relative effectiveness of D-frame dip nets, quatrefoil light traps, and towed ichthyoplankton nets for larval muskellunge. North American Journal of Fisheries Management 41:1334-1340.

5-Upper Wisconsin River Genetics Management Unit brood lake report-Preliminary Pelican Lake Musky Fingerling PIT Tagging Report 2021 Author: Chad Leanna 8/24/21

2012 Stocked Fish

2015 Netting

5 tagged males captured- Age 3

Average Length in 2015	Growth per Year	Growth/Year after stocking (Age 2-3)
24.5 Inches	8.2 Inches	6.5 Inches

No females Captured 2018 Netting

35 tagged males captured- Age 6

Average Length in 2018	Growth per Year	Growth/Year after stocking (Age 2-6)
32.9 Inches	5.5 Inches	4.2 Inches

17 tagged females captured- Age 6

Average Length in 2018	Growth per Year	Growth/Year after stocking (Age 2-6)
37.5 Inches	6.2 Inches	5.1 Inches

2021 Netting

28 tagged males captured- Age 9

Average Length in 2021	Growth per Year	Growth/Year after stocking (Age 2-9)
35.0 Inches	3.9 Inches	2.9 Inches

24 tagged females captured- Age 9

Average Length in 2021	Growth per Year	Growth/Year after stocking (Age 2-3)
40.7 Inches	4.5 Inches	3.6 Inches

2015 Stocked Fish

2018 Netting

1 tagged male captured- Age 3

Length in 2018	Growth per Year	Growth/Year after stocking (Age 2-3)
26.6 Inches	8.9 Inches	7.5 Inches

No females captured

2021 Netting

12 tagged males captured- Age 6

Average Length in 2021	Growth per Year	Growth/Year after stocking (Age 2-6)
32.6 Inches	5.4 Inches	4.1 Inches

14 tagged females captured- Age 6

Average Length in 2021	Growth per Year	Growth/Year after stocking (Age 2-6)
35.8 Inches	6.0 Inches	4.7 Inches

The 2018 stocked fish did not show up yet during musky egg collection netting in 2021.

There were 13 known age muskies (2012 Stocking) captured in both 2018 and 2021 that were measured. **Males** (7) Growth per year after stocking (Age 1-6) = 4.3 inches Growth Per Year (Age 6-9) = 0.8 inches **Females** (6) Growth per year after stocking (Age 1-6) = 4.8 inches Growth Per Year (Age 6-9) = 1.7 inches

