Escocid Technical Committee
State/Provincial Updates - North Central and Southern Division
Winter Business Meeting in Milwaukee, WI
January 28th, 2018

North Central Division Updates

Dakotas
Prepared by: Brian Blackwell

South Dakota

At the January 2018 South Dakota Department of Game, Fish and Parks Commission Meeting, a private individual proposed establishing a statewide 50-inch minimum length limit for Muskellunge/Tiger Muskellunge. South Dakota currently has a statewide 40-inch minimum length limit for Muskellunge/Tiger Muskellunge. The Commission rejected the proposal, but made a subsequent proposal that Muskellunge/Tiger Muskellunge be catch and release only statewide. The catch and release proposal is currently open for public comment with a public hearing scheduled for March 1 at 2 pm. At that time the Commission may pass, reject or modify the proposal.

In 2018, Blue Dog State Fish Hatchery raised 4,748 fingerling Muskellunge that were stocked into Lake Sinai (3,206) and Middle Lynn Lake (1,542) in September. Mean total length of fish raised was 267 mm. The fish stocked into Middle Lynn Lake were PIT tagged prior to stocking.

A new Master's of Science project beginning in July 2018 will evaluate post-stocking survival, movement, and habitat use of fingerling muskellunge in four eastern South Dakota lakes. The student working on the project will be attending the University of Nebraska Kearney. Co-principal investigators include Melissa Wuellner (University of Nebraska Kearney), Dan Dembkowski (University of Wisconsin Stevens Point), Brian Blackwell (South Dakota Department of Game, Fish and Parks) and Dave Lucchesi (South Dakota Department of Game, Fish and Parks).

Northern Pike numbers continue to be down across eastern South Dakota most likely due to the lack of spring runoff for several years. As a result, the southeast fish management area was unable to collect an appreciable number of Northern Pike during spring trap and transfer operations. Therefore, no Northern Pike were stocked into community fishing ponds in southeast South Dakota in 2017.

North Dakota

The North Dakota Game and Fish Department jaw-tagged 75 Northern Pike ≥ 1 meter in length on the North Dakota portion of Lake Oahe in April of 2017 in an effort to gain a better understanding of how anglers may be utilizing these trophy fish. As of January 2018, anglers have reported catching 12 of these fish, three of which were harvested. Most anglers reported catching the tagged pike within 15 miles of their tagging location; however, several fish traveled 56-57 miles downstream.

On Lake Sakakawea, 62 pike ≥ 1 meter in length were tagged in the spring of 2017. As of January 2018, anglers have reported catching three of these pike, one of which was harvested. All tag returns on Lake Sakakawea, to date, were in close proximity (<5 miles) of their initial tagging location.

Plans are to tag additional trophy Northern Pike in the spring of 2018 in both reservoirs.

Illinois
Prepared by:

Indiana
Prepared by:

Iowa
Prepared by: Jonathan Meerbeek

Muskellunge Stocking, Tagging, and Population Dynamics (Contact: Jonathan Meerbeek jonathan.meerbeek@dnr.iowa.gov) - Thirteen lakes and impoundments are currently being managed as Muskellunge fisheries. In 2017, 1665 yearling (mean TL = 13.1") Muskellunge 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. In 2017, 453 broodstock Muskellunge were captured (262 recaptures) ranging from 25.1-50.0 inches in these lakes. Adult (≥ 30 inches) Muskellunge population estimates for 2016 in the Spirit Lake/Okoboji Chain and Clear Lake were 0.04 and 0.15 fish/acre, respectively. Adult Muskellunge population estimate was attempted in Black Hawk Lake, but lacked sufficient sample size. Currently, spring-stocked, pellet-started minnow finished yearlings are used in Iowa's Muskellunge culture program. All yearling Muskellunge stocked into Iowa's natural lakes are tagged via PIT tags prior to stocking (since 2011). In 2011 and 2012, yearlings were tagged in the check and tag retention was poor (52%; 118 of 225 tagged) at 2-3 years post-tagging. Since 2013, all yearling Muskellunge were tagged in the dorsal musculature and retention (2-3 year) in this location was was 98% (45 of 46). Short-term PIT tag retention studies conducted by IA DNR and IA State, as well as other published literature, have found high retention rates for PIT tags inserted in this location. Conversely, PIT tag retention for tags (12mm, 23mm, and 32 mm) inserted in the body cavity of fall age-0 Muskellunge has been relatively poor. Evidence of natural reproduction has been observed in both Clear Lake and the Okoboji Lakes as several yearling Muskellunge have been captured during non-stocked years. Although natural reproduction has been documented in the past, this is the first time that several individuals were captured from each system.

Big Creek/Brushy Creek Muskellunge Emigration Study (Principle Investigators: Ben Dodd Ben.Dodd@dnr.iowa.gov, Ben Wallace Ben.Wallace@dnr.iowa.gov, and Michael Weber mjw@iastate.edu) - Iowa State University, the U.S. Army Corps of Engineers and the Iowa DNR are collaborating on a Muskellunge emigration study at two central Iowa impoundments, Big Creek Lake (814 ac) and Brushy Creek Lake (690 ac). A horizontal bar barrier was installed at the Big Creek spillway in 2012. Brushy Creek has no barrier but is similar in size, depth and watershed:lake ratio, and is serving as a reference lake for this study. PIT tag readers and antennas were installed on the spillways of both impoundments to quantify fish escapement and evaluate the efficacy of the barrier. Nighttime boat electrofishing and gill nets were used to collect Muskellunge in April 2016 and 2017. In both years combined, we collected 48 adult Muskellunge at Big Creek and 73 adult Muskellunge at Brushy Creek Lake and implanted a 32mm HDX PIT tag into the dorsal muscle of each fish. Additionally, 593 and 504 age-1 Muskellunge were PIT tagged prior to being stocked into Big Creek and Brushy Creek, respectively. Two adult Muskellunge escaped from Brushy Creek (no barrier) in 2016, which was approximately 4% of the tagged fish from 2016. No adult Muskellunge escapement was detected from Big Creek (barrier) in 2016. In 2017, 12 tagged Muskellunge emigrated from Brushy Creek (28 to 37”). Nine of those fish were tagged in 2016, one of which was radio tagged. The other three were tagged in 2017, one of which was radio tagged. The three that were tagged in 2017 escaped less than a month after being collected. At Big Creek, we had two Muskellunge escape during the first two weeks of May. Both of those fish were tagged at Rathbun and stocked during May 2016.

Muskellunge Emigration/Relocation Telemetry (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. In 2017, the area directly below the outlet dam was sampled via electrofishing to collect Muskellunge and determine if escapement has occurred post-barrier installation via PIT tag information. Twenty-three Muskellunge (28-48”) were collected below the electric fish barrier from July to October (7 sampling events) and of these, 13 (57%) were known to have emigrated from the lake to the river post-electric barrier installation. To further understand the dynamics of emigration and affinity to the river, we implanted external radio transmitters on 7 fish, 3 of which were relocated 0.5 miles upstream in lake, 4 were relocated 1.5 miles upstream in lake. Within 24 hr, one fish (42.5”) that was relocated 0.5 miles upstream went over the electric fish barrier in less than 3.5” of water back to the river and was recaptured via electrofishing below the barrier. This fish was then transported 1.5 miles upstream and remained in the lake until the transmitters transpired (57 days post relocation). All other fish stayed in the lake system and exhibited varying levels daily movement and depth preferences. In general, most fish stayed relatively shallow (< 10’) and utilized aquatic vegetation for cover/feeding. This study demonstrated that Muskellunge emigration continues to be a management concern in lakes with electric fish barriers.

Yearling Muskellunge Survival Study (Principle Investigators: Jonathan Meerbeek jonathan.meerbeek@dnr.iowa.gov and Michael Weber mjw@iastate.edu) – Year two of a stocked yearling Muskellunge telemetry project was completed in 2017. Specific objectives of the project were to evaluate post-stocking survival of stocked yearling Muskellunge in Spirit Lake, Iowa and to compare cohort survival via three stocking techniques: (1) stocked directly at ramp; (2) transported to holding tanks at Spirit Lake Hatchery for 36 hours (to allow for hauling stress recovery) then stocked at boat ramp; (3) transported off-shore via boat and stocked. In 2016, we found that all yearling Muskellunge stocked from the ramp experienced low Initial mortality (2.4%). Fish stocked offshore were difficult to detect via radio telemetry and initial mortality could not be estimated. In 2016, known mortality over 100-d was 10%, 35%, and 20% for direct, hatchery holdover, and offshore stocked fish, respectively, and was significantly related to fish size at stocking, with larger fish (≥13.0") surviving better. In 2017, an additional 20 yearling Muskellunge were affixed with radio tags from both the direct stocking and the holdover stocking types and tracked for up to 100 days post-stocking. Combining both years data, overall yearling Muskellunge survival was 64% and was not influenced by stocking technique or hauling stress. 27% of the observed mortality occurred within the first week post-stocking and 96% occurred within the first 60 days. Great Blue Herons accounted for at least 15% of total known mortalities. Combined, length at time of stocking was the only variable that significantly influenced 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. Based on these data, production techniques that result in larger fish size will benefit Muskellunge populations in Iowa. In 2018, only yearling Muskellunge ≥13.0" will be stocked. Fish will be sorted by size in May and fish not exceeding the minimum length of 13.0" will be reared for up to 60 additional days. Prior to stocking, fifteen extended grow-out Muskellunge will be affixed with radio telemetry tags and initial and short-term mortality will be investigated. Findings from this study will guide Iowa's production and stocking techniques.

Northern Pike Propagation and Stocking (Hatchery Manager: Kim Hawkins kim.hawkins@dnr.iowa.gov - Northern Pike propagation is still an important component to manage these fish in lakes, rivers and impoundments across Iowa. In 2017, 236,963 Northern Pike fry, 289,261 Northern Pike 3-inch fingerlings, and 596 10-inch fall fingerlings were stocked.

Kansas

Prepared by: Andrew Schaefer

Kingman State Fishing Lake is a shallow 58 hectare impoundment located in Kingman County in south central Kansas. Emergent and submersed aquatic vegetation covers approximately 30% of the lake, primarily in the western lobe. A spring located in the northern lobe of the lake provides a thermal refuge that allows Northern Pike Esox Lucius to survive through the summer. It is the only public Northern Pike fishery in Kansas. Anglers are allowed to harvest two Northern Pike >762 mm per day.

In 2012, the lake was chemically renovated to remove invasive White Perch *Morone americana*. The lake was restocked with Northern Pike fingerlings in 2013 and 2014. The population is sampled with experimental gillnets every fall, except in fall 2016 when sampling was not conducted because of staff turnover. Northern Pike CPUE was 2.3 fish per net night in 2017, which represents the latest in a declining trend since 2014 (Table 1). Additionally, size structure indices have steadily increased since 2014. No individuals smaller than quality size have been sampled since 2014. Furthermore, no juvenile Northern Pike have been observed during other sampling efforts, such as spring Largemouth Bass

electrofishing. Based on this evidence, it seems likely that the stockings in 2013 and 2014 were successful at producing an adult population of fish, but no natural recruitment has yet occurred. This is somewhat puzzling because the Northern Pike population at Kingman State Fishing Lake was self-sustained from natural recruitment prior to the renovation in 2012, and habitat conditions don't appear to have changed. In 2017, otoliths were removed from five individuals that experienced mortality during sampling to confirm their age. While their age information is still forthcoming, biologists noted that all five (three males, two females) were sexually mature. If the population continues to decline with no signs of natural recruitment within the next couple of years, KDWPT will have to consider a stocking program to maintain the fishery.

Michigan

Prepared by: Cory Kovacs

Great Lakes Muskellunge Production and Stocking 2017:

- Due to an epizootic of VHS on the Detroit River in spring 2017, no Great Lakes Muskellunge eggs were collected. Following, many attempts to seek alternate locations as a brood source, Fisheries Division decided to not move forward with any Great Lakes Muskellunge egg take in 2017.
- 1,365 northern strain Muskellunge fall fingerlings from WI stocked into 3 locations in Southern Michigan.

Great Lakes Strain Muskellunge Stocking Evaluations:

- Only one evaluation of stocked Great Lakes Muskellunge was conducted in 2017. Dana Lake in the central Upper Peninsula was surveyed in May. Zero Great Lakes strain fish were found however northern strain fish was captured from the 2010 cohort. Stocking years for Great Lake strain fish were 2012, 2013, and 2015. Young Muskellunge may have not recruited to netting gear just yet.

Muskellunge Population Evaluations

- Muskellunge in the Inland Waterway in northern Michigan are being evaluated with a long-term tagging project. Button tags and loop tags were used. Much is unknown about the movement and population distribution in this system. Many fish were captured and crews found spawning fish into late May.

Regulations:

- Fisheries Division's Esocid Committee led a thorough review of Muskellunge regulations statewide. Regulations considered for changes were minimum size limits, harvest and catch and release seasons, elimination of the harvest tag, and a mandatory registration system. The following is a brief summary of regulation changes that will be implemented for the 2018 fishing season beginning April 1, 2018.
    - Elimination of Muskellunge harvest tag and replacement with mandatory registration. Registration system will be a call-in, online, and in person suite of options.
    - Statewide harvest season delayed to First Saturday in June for protection of vulnerable spawning adults in many systems.
    - Statewide catch and immediate release season outside of the harvest season.
    - Minimum size limit categories implemented per the Michigan Muskie Management Plan. Size categories are now 38, 46, and 50 inches. Statewide MSL remains at 42 inches. A growth model was built using most recent age and growth data to guide managers on their decision on growth potential for their respective waterbodies.

- Northern Pike regulations were considered on a lake by lake basis and did not undergo a large scale change. Many waters where changes were desired by public had either no data or not enough data to support changes.

Muskellunge Angler Survey postcards and online (cooperative with Michigan Muskie Alliance):

- **2016**
    - Survey moved completely to online submissions
    - 474 total responses
    - 2,580.7 total reported angler hours
    - 5.4 hours on average angler trip
    - On average anglers caught .55 fish per trip
        - Took two trips to catch at least 1 fish
    - A total of 263 Muskie were reported
    - Zero fish reported as harvested
    - 55% trips fished in stocked waters
- **2017**
    - Survey running through March 15 (season closure). Data not yet available.

Adult Northern Muskellunge Transfers

- In order to reduce the number of competing predators in Michigan's Muskellunge broodstock lakes, Fish Division conducted a wild fish transfer project in the spring of 2017. Thornapple and Hudson Lakes have been designated as Michigan's Great Lakes Muskellunge inland broodstock waters. These lakes are being developed for our inland broodstock lakes in efforts to move away from relying on the Detroit River and to have earlier and more consistent egg takes. Hudson and Thornapple lakes were stocked for many years as Michigan's northern strain Muskellunge broodstock waters. Stocking of northern strain fish ceased in these lakes in 2010. This transfer effort targeted northern strain Muskellunge for removal. Lakes selected for receiving waters were waters with no outlets to Great Lakes populations, relatively close to donor lakes, and had not been previously stocked with Muskellunge. Lower Crooked Lake in Barry County and Orchard Lake in Oakland County were selected to receive fish.
- A total of 97 adult northern strain Muskellunge were transferred. Orchard Lake received 31 adults from Lake Hudson. Lower Crooked Lake received 66 adults from Thornapple Lake.
- Field crews anticipated more fish, however weather patterns and water temperatures did not cooperate with the crews schedule for netting.

Minnesota

Prepared by: Mike Habrat

Muskellunge Production

- Eggs were taken from Leech Lake in 2017 in addition to standard brood source lakes. This occurs every four years in an effort to periodically infuse fresh genetics into the brood lake system. Only progeny from Leech Lake are stocked into (five) brood lakes in these years, any extra are used to fulfill standard base quotas.
- MN DNR produced 29,445 fingerlings and 291adults (age 3+) in 2017. Fingerling base stocking quotas were filled to about 91%. The shortfall was largely due to default from a private vendor contract.
- News from Waterville State Fish Hatchery: In 2017 the hatchery went through an extensive filter/pond filling process which removed extraneous species most notably Walleye from the rearing

ponds which resulted in major losses in 2016. Minnow spawning habitat (4,400 feet of 4" PVC pipe with holes for spawning cavities) was also placed in ponds to propagate early life stage forage for transplant (3-4") Muskellunge. These two components were identified as critical for improving survival. Muskellunge are grown out in ponds for 4 months to reach acceptable stocking size. The first month when transplants are stocked in ponds generally has far greater mortality than the remainder of the grow-out period. The minnow spawning habitat also created supplemental forage.

Waterville achieved a 4 to 1 food conversion and 43% survival in 2017 (10,356 fish).

A fry stocked pond was also attempted in 2017. Average size was half of an inch larger for the fry stocked pond than the overall mean. A similar number was harvested per acre (650) compared to the overall harvest per acre (580). More ponds will be utilized in 2017 for fry stocking; the benefits of larger fish, less expensive product and the ability to restock with transplants if the fry have poor survival is advantageous.

Standardized sampling was also implemented in 2017 this will allow catch effort and growth data to be compared amongst ponds and adjust variables accordingly. Correlation in 2017 with catch per effort and number of fish at harvest gives us valuable information for managing ponds going forward.

<u>Muskellunge News</u>

- Muskellunge, and Muskellunge stocking in particular, are expected to be a hot-button issue in 2018. The present sociopolitical opposition from non-Muskellunge anglers is currently the largest 'threat' to Minnesota's introduced Muskellunge populations.
- Staff conducted a project evaluating the proportion of Muskellunge that were caught and re-captured by a subset of anglers relative to the population in the Mississippi River near Brainerd and Baby and Man lakes near Walker. Participating anglers captured a minimum of 11–22% of the population at both sites annually, of which an additional 1–3% were subsequently recaptured within the year. Although the proportion of fish that were recaptured by anglers was low relative to each population, recaptured fish did provide anglers with additional opportunities and added to the total number caught by up to 16% annually. See: Bahr et al. 2018. Recapture rates and size-selectivity of Muskellunge by anglers within two Minnesota fisheries. North American Journal of Fisheries Management In Press.
- Continued genetic evaluation of Minnesota Muskellunge populations led by Dr. Loren Miller (MNDNR / University of Minnesota). Genetic project work over this past year focused on 1) an assessment of the contribution of Minnesota and Wisconsin stocked strains to the Muskellunge population in the St. Louis River – both strains have survived and are contributing to natural reproduction and 2) determining the ancestry of the introduced population in Island Lake Reservoir – only Leech strain was detected.
- Collaborative project funded by Minnesota Sea Grant between the University of Minnesota, MNDNR, and WIDNR is evaluating movement, habitat use and population dynamics of Muskellunge in the St. Louis River. This past spring, Graduate student Erin Schaeffer with advisors Dr. Loren Miller and Dr. Paul Venturelli (Ball State) led work resulting in the acoustic tagging of 60 adult Muskellunge from the St. Louis River. Throughout the past 7 months they have been tracking their movements and habitat use throughout the estuary and Lake Superior.
- Movement of Muskellunge in East Metro's large rivers is being evaluated by Joel Stiras – East Metro, MNDNR. The objectives of this work were to establish movement of patterns of wild fish throughout this part of the river system and evaluate how stocked fish move after introduction into

a new riverine system. To date, 18 muskies have been implanted with acoustic transmitters throughout this section of river. Data is still being analyzed, but of note, three fish tagged near the mouth of the St. Croix moved upstream over 50 miles to Taylor Falls while others stayed locally or moved back and forth between the St. Croix R. and Pools 3 and 4 of the Mississippi.

Northern Pike Regulations

New statewide Northern Pike regulations go into effect with the opening of the gamefish season in May 2018. The previous statewide regulation, a three-fish bag limit with one allowed over 30 inches, is being replaced with a three-zone system with regulations specifically designed to meet the unique management challenges of these geographic zones. This will be the biggest advancement in Northern Pike management since the first experimental regulations were initiated in the 1980's.

- When the new regulations take effect this spring, the majority of the state will be in the north-central zone where the issue is overpopulation of small pike. Anglers here will be able to keep 10 northern pike, but not more than two pike longer than 26 inches, and all from 22 to 26 inches must be released. Northern pike taken by winter spearing follow the same rules except one pike may be between 22 and 26 inches and one longer than 26 inches.
- In the northeast zone, the new regulation will maintain harvest opportunity and protect large fish already present and anglers here will be able to keep two pike and must release all from 30 to 40 inches, with only one over 40 inches allowed in possession. Spearers also will be able to take two pike but only one may be longer than 26 inches.
- In the southern zone, the regulation will intend to increase pike abundance and improve the size of fish harvested. Anglers and spearers will be able to keep two fish, with a minimum size of 24 inches.
- Lakes with special or experimental regulations will remain in place until the special regulation has been evaluated and a decision made through a public process to continue the special regulation, modify it or convert to the zone regulation.
- The old statewide regulation was daily (and possession) limit of 3, of which only one could be longer than 30 inches.

Missouri

Prepared by: Mike Anderson

- The highlight for Missouri was the completion of the next 10-year plan (**see attached**). Dedicated biologists, hatchery personnel, and our leadership in Jefferson worked hard on this document and completed it in less than a year. The plan has current sampling information through 2017, Show-Me Muskie project results through 2016, and updated and better-defined goals and objectives. This document should be on our public website soon. https://mdc.mo.gov/
- All of our program lakes received the requested number of ≥ 12-inch muskie fingerlings last November.
    - Pomme de Terre Lake (7,820 acres) – 5,210 fingerlings
    - Fellows Lake (820 acres) – 647 fingerlings
    - Hazel Creek Lake (530 acres) – 532 fingerlings
    - Henry Sever Lake (158 acres) – 161 fingerlings (designated as a lake for surplus fingerlings)
    - Lake 35, Busch Conservation area (62 acres) – 100 fingerlings

- Participants in the Show-Me Muskie Project, a voluntary muskie angler reporting system, have historically completed paper Daily Trip forms. At the end of the year, the Muskie Coordinator requests the completed forms and provides the angler new forms for the upcoming fishing season. For a number of years, anglers have been requesting that MDC set up an on-line reporting system. Under Dave Woods, a Show-Me-Muskie Project App was developed, and we hope this App will be available to our anglers in the very near future.

Nebraska

Prepared by: Keith Koupal

The following report is being submitted to the Esocid Technical Committee meeting in January 2018 at the Midwest Fish and Wildlife Conference. Nebraska has limited use of esocids within our systems. We are managing to stock both muskie and northern pike in the requested systems at 2-3-year intervals. 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. Recent interest in the muskellunge fishery at Merritt Reservoir has initiated a consideration for a 50" minimum length regulation on this water that is currently being considered.

Northern pike production has hit a snag. There has been a decline in hatch percentage of broodstock spawned from our National Refuge lakes near Valentine Nebraska. Analysis of data collected during historic efforts to spawn northern pike from these locations has noticed a positive correlation between water temperature and successful egg fertilization. Investigations associated with egg collection and culture will concentrate on expanding our knowledge of temperature effects for egg fertilization and hatch percentage. We realize that we are not able to change temperatures in natural systems but do know that options of when we go to collect spawn are adjustable. We continue to seek out any advancements of understanding that other states may have for northern pike spawning operations.

A northern pike tagging project was started at Lake Wanahoo in March 2012 with the goal of getting a population estimate, and to monitor population dynamics such as length frequency, dynamics, and growth. Northern pike are collected with trap nets in the spring and floy tagged. Population estimates indicate a stable population within the reservoir from 2012-2017. Sex-specific growth increments were calculated using recaptured fish since aging structures are not being collected (see Jordan Katt for more details on methods). Tracking of the first year-class stocked into the reservoir was used to determine if/when recruitment has occurred from later stockings of northern pike. Results of this showed limited recruitment, with 61% of the overall population still consisting of the original stocked year-class even though advanced (10-12" fish) have been stocked annually 2012-2015. The population estimates generated from this work are incredibly tight (between 2,063-2,111 northern pike in this lake) and is also expanding on our understanding the sexually dimorphic growth differences between males and females. This project is scheduled to continue into the future.

The only other esocid mention in research activity was a compilation of muskellunge sampling, growth and condition for all Nebraska waters by a graduate student at University of Nebraska-Kearney. This exercise used the existing sampling database from the Nebraska Game and Parks Commission Fisheries Division to determine growth curves, relative weights. The lack of individuals captured by standard sampling techniques indicates a need to specifically sample for this species or potentially cooperate with anglers who may be handling more individual fish than sampling gear. The report generated from this

work was the nexus for creating an extended abstract on management of muskie in Nebraska that was recently published in the Muskellunge Management AFS book.

Ohio
Prepared by: Curt Wagner

No big advances or changes from last year. Still working on collecting data for ongoing projects. See last year's report for project descriptions including tagging study and angler log.

Ontario
Prepared by: None submitted

Wisconsin
Prepared by: Jordan Weeks

WI Musky Standing Team Meeting
WDNR Service Center, 10220 ST HWY 27, Hayward, WI 54843
September 20, 2017; 9 am to 4:30 pm

Members present: Aaron Cole, ND; Gene Hatzenbeler, Treaty; Steve Hogler, ED; Zack Lawson, ND; Neal Rosenberg, Fish Culture; Dave Rowe, SD; Tim Simonson, SD; Tim Parks, OAS/ND; Jordan Weeks, WD; Mark Luehring, GLIFWC; Chuck Brod, Musky Clubs Alliance; Steve Budnik, WCC; and guests Joe Weiss, WCC; Don Gilbert, Musky Clubs Alliance; Wes Larson, UWSP; Mike Persson, Hayward Lakes Chapter Muskies, Inc.; Amos Milton, Fish Culture; Matt Kufahl, Treaty; Max Wolter, ND

1) 2017 Spring Hearings. 2017 Spring Hearings – 1) Statewide motor trolling rule (simplify the current rule, which will sunset in April 2018). 2) Consolidate trophy regulations for muskellunge; increase minimum length limit from 45" to 50" on Wisconsin River, DuBay Dam to Castle Rock Dam, Adams, Juneau, Portage and Wood counties; Lakes Monona, Waubesa, and Wingra, Dane County; Chippewa River, Winter Dam to Arpin Dam, Sawyer County; Little Saint Germain and Trout Lakes, Vilas County; change from "catch and release only" to a 50" minimum length limit on Yellowstone Lake, Lafayette County. 3) Increase the minimum length limit from 40" to 50" on the Wisconsin River, Castle Rock Dam (Adams and Juneau counties) down to the WI & Southern Railroad Bridge, Sauk City (Columbia, Dane and Sauk counties) including Kilbourn Flowage and Lake Wisconsin; Lake Wissota, Chippewa County; Holcombe Flowage, Chippewa and Rusk counties; High Falls and Caldron Falls Flowages, Marinette County; Katherine Lake and Willow Flowage, Oneida County; Whitefish Lake, Sawyer County; North and South Twin Lakes, Vilas County; and Lake Geneva, Walworth County. Approved by the NRB and Governor's Office, awaiting Legislative review.

	Votes		Counties		
Proposal/Question	Yes	No	Yes	No	Tie
Trolling	2217	1581	57	15	0
45" to 50" - Dane, Lafayette, Portage, Sawyer, and Vilas	2208	989	57	11	4
40" to 50" - Adams, Chippewa, Columbia, Dane, Juneau, Marinette, Oneida, Rusk, Sauk, Vilas, Walworth	2208	1066	54	16	2

Hook-and-line harvest tag (ADVISORY)	1912	1865	30	39	3
Willow Flowage 50" (440216) (ADVISORY)	2304	1032	53	16	3
Wisconsin River 50" (010116) (ADVISORY)	2164	1020	56	13	3
Katherine Lake 50" (440116) (ADVISORY)	1985	913	61	11	0

Northern Pike

QUESTION: Quality Northern Pike management—Waukesha County
This proposal is to extend the sunset clause from 2018 to 2021 for further evaluation of the current 40-inch minimum length limit and daily bag limit of one northern pike per day on Big Muskego Lake and Bass Bay in Waukesha County. This regulation has been in place since 2010. Preliminary results suggest significant improvements to the size structure and abundance of northern pike on Big Muskego and Bass Bay, but an extension of the sunset clause will allow further study of the regulation's impacts. A question to either make the rule permanent or adopt a different rule would be offered at the 2021 spring hearings.
RESULTS:
Do you favor extending the sunset clause from 2018 to 2021 for further evaluation of the current 40-inch minimum length limit and daily bag limit of one northern pike per day on Big Muskego Lake and Bass Bay in Waukesha County?
YES = 2092 NO = 641 Majority = YES (68/72 counties approved)

QUESTION: Northern Pike harvest opportunity—Racine County
The proposal would apply a daily bag limit of 5 fish and no minimum length limit on northern pike in Browns Lake, Racine County. The current regulation is a daily bag limit of 2 fish and 26-inch minimum length limit.
The management goal is to reduce the abundance of northern pike, which are currently overpopulated and stunted in Browns Lake. Quality pike fishing is not currently being provided by the 26-inch minimum length limit, as legal fish are rarely captured by DNR crews or anglers. The objective is to reduce northern pike abundance and improve size structure through decreased competition. The regulation proposal allows anglers to harvest more and smaller pike to improve the population as a whole and the overall fishing experience in Browns Lake. Staff will reevaluate this proposal in the coming years with follow-up fisheries assessments.

RESULTS:
Do you favor applying a daily bag limit of 5 fish and no minimum length limit on northern pike in Browns Lake, Racine County?
YES = 1934 NO = 764 Majority = YES (67/72 counties approved)

2) 2017 Citizen Resolutions – Warmwater Study Committee, WI Conservation Congress; endorsed by the Musky Team. These will likely appear as WCC Advisory Questions in Spring 2018.

County	Res. #	Title	Yes	No
Vilas	640317	Change northern musky season remain open until 12/31 or ice up, whichever is sooner	42	15
Vilas	640617	Raise the minimum size limit for musky to 50" on White Sand Lake	41	18
Vilas	640717	Raise the minimum size limit for musky to 50"	37	20

		on the Cisco Chain of Lakes		

3) 2018/19 WDNR Rule Proposals? We discussed pursuing an advisory question on registration of harvested muskellunge.

4) Trolling data from Northern Distirct Creels – Gene Hatzenbeler presented data based on creel surveys of anglers. During 2014, 2015 and 2016, trolling (motor or row) was used in 11 percent of the 11,511 interviews conducted on 35 lakes open to trolling. Anglers used trolling to target walleye, muskellunge, largemouth bass, smallmouth bass, black crappie, bluegill, rock bass, yellow perch, rainbow trout and brown trout. Trolling accounted for 13% of the directed effort (hours/acre) for walleye and 10% of the directed effort for muskellunge and northern pike; trolling was 2% or less of the directed effort for other species. Catch rates did not differ between trolling and casting techniques for any species except black bass, where casting resulted in significantly higher catch rates. The mean length of harvested walleye was significantly higher for trolling (17.6") versus casting (16.5"), but may have been related to the lakes that were included in the study (e.g., most of the harvest came from the Turtle-Flambeau Flowage, which received very little trolling effort and tends to have smaller walleye), and differed by only 1 inch, which is likely not biologically significant. Trolling appeared to have no significant impact on fish populations in the 35 lakes.

5) "Extended Growth" large fingerling musky project – Max Wolter, Neal Rosenberg and Mike Persson described the partnership that has developed between GTH and Muskies, Inc., who has been donating money to hold muskies in ponds longer into the fall to increase the size at stocking. This extended rearing typically results in about 13" fingerlings, which are stocked into the brood stock lake from which they came. Max is seeing early indications of excellent survival of these fish, which are all PIT tagged, post-stocking. Some ongoing concerns with the program are raptor predation on ponds, aging pond liners and availability of forage.

6) Rearing Muskellunge on Pellets vs. Minnows. We reviewed the results of the UWSP study comparing the cost-to-rear and post-stocking survival of fish reared using two techniques at the Wild Rose State Fish Hatchery (WR). Half the fish were raised in ponds using traditional methods and half the fish were started on dry food in tanks and then moved to ponds and "finished" on minnows for about 60 days. During 2013-2016, fingerling Muskellunge were reared, marked, and stocked in 43 lake-year paired-stocking replicates throughout Wisconsin. A total of 11,334 Minnow Only (MO) and 21,075 Minnow Finished (MF) fingerlings were stocked during the study. Across all years, size and condition at stocking was significantly higher for MO fish compared to MF fish ($P<0.01$ for all comparisons), with MO fish averaging 12.5" and MF fish averaging 10.8"; MF fish rarely reached 12". Health metrics were similar for both treatments across years. Nighttime boat electrofishing catch rates were used to asses short-term (2-6 weeks) post-stocking survival. A total of 698 MO (8.7%) and 756 MF (5.0%) fingerlings were recaptured. Mean relative survival across all lakes and years (for all paired stockings) was 1.44 MO to every 1.00 MF fish. Rearing costs were approximately 35% higher for MO fish compared to MF fish. However, accounting for post-stocking survival, MF fish were only 8% cheaper. Formulated feeds may be a viable method if the cost to rear more individuals (to offset reduced survival) is less than the cost to rear fish on natural prey and hatcheries have available rearing space and infrastructure. Based on these results, 35% more muskies would be required to offset the reduced survival of these fish. Assuming a demand of about 15,000 muskellunge, an additional 5,250 fish would have to be produced, at an estimated cost of $57,510, versus $63,900 for MO fish. However, on average, 30% of MF fish (versus 10% of MO fish) were < 10"; in either case, these fish are unlikely to contribute to the fishery. We recommend

moving all universal receptor quotas to WR, with continued efforts to start muskellunge on dry food, but suggest that eggs be obtained earlier in spring from southern waters, rather than waiting for eggs from northern Wisconsin (these basin-specific eggs have been increasingly more difficult to obtain and spawning dates in NE WI are much later than in southern WI). This will provide a longer growing season for these fish, which should be finished on minnows for as long as needed to achieve an average length of at least 11" prior to stocking in Universal Receptor waters; any fish < 10" are unlikely to survive. We will continue to evaluate the longer-term survival of these fish as they enter adulthood.

7) Inland Brood Stock lake discussion – Amos Milton gave us a background and spawning data for Lac Courte Oreilles. During 2017, it was very difficult for the Thompson hatchery to obtain eggs. There has been a trend towards fewer spawners over the last 3 cycles, which has been a source of difficulty. We discussed a general trend observed during 2017 where muskies seemed to show up early in netting operations and were then difficult to sample later when they should have been spawning. In the interim, Max will be looking at (netting) potential alternate brood stock lakes (and collecting genetic samples), and we will plan to take eggs from LCO again in 2020, with an expanded list of connected, alternate lakes (Grindstone, Whitefish) where hatchery staff can expand operations if needed. We also discussed the idea of conducting longer-term performance studies to look at survival and growth of muskellunge from alternate brood stock lakes that may have a reputation as slower-growth populations. This idea will require additional discussion with UWSP researchers to develop a study plan.

8) PIT Tagging Procedures/locations – We reviewed a draft proposal to standardize PIT tagging procedures and location for future marking efforts. A recent study (Weber & Flammang 2017) suggested that PIT tag retention can be very low when placed in the body cavity. Most other studies suggest that tagging in the dorsal musculature results in the highest tag retention. A long-term study by Rude et al. (2011) found that tag retention was 99.9% for adults over 10 years. The Musky Standing Team recommends that the WDNR implant PIT tags in the dorsal musculature as the standard tagging location for muskellunge of all sizes. Once approved by the FMPT, the procedures document will be incorporated into the Fish Management Handbook.

9) Aquaculture Bill – As part of the Aquaculture Bill (2017 Act 21) Species Standing Teams are asked to develop a Genetics Management Plan for each species that is stocked in Wisconsin. Simonson drafted a version of this based on our existing genetics management guidelines and distributed to team members for review and comment. Please review and send comments to Tim by **October 13, 2017**.

10) Great Lakes Spotted Musky Update – Steve Hogler provided an update on the GLS musky program. The Yearlings at Wild Rose were stocked into the brood stock lakes (1,350), Green Bay (5,424), and Lake Winnebago (500). No muskellunge were available from Michigan this year due to a VHS outbreak on Lake St. Clair, so brood stock lakes were stocked at a higher rate this year (1.5/acre) to help make up for the shortfall in 2018. Hopefully, we'll get fish in 2018 for stocking in 2019. Large fingerlings at Kewaunee will be stocked in mid-October (ended up harvesting 3,295). This spring, during egg-take operations, Steve and his crew handled a 56.3" (49 pounds) musky in the Fox River, the largest to date, which was originally tagged in 2009 at 50.2" (34 pounds). An angler reported catching a Floy tagged fish at 52" – the fish was determined to be 14 years old and Steve believes was about 16 years old. Fishing effort on Green Bay has been at an all-time high over the last 3 years. Catch/effort has remained similar over the last 8 years.

	2015		2016		2017	
	Fingerlings	Yearlings	Fingerlings	Yearlings	Fingerlings	Yearlings
Brood Lakes	--	2,583	--	900	--	1,350
Green Bay	5,700	6,348	4,411	4,323	3,295	5,420
Winnebago	--	650	--	426	--	500

11) Updates on UWSP ongoing musky studies; We received and reviewed written summaries of ongoing muskellunge studies at UWSP (attached).
    a. Variability in adult muskellunge abundance;
    b. Pellet vs. minnow;
    c. Juvenile habitat use/catchability; PowerPoint from Summer ETC meeting;
    d. GB telemetry Project;
    e. Hooking mortality at high water temperatures;
    f. Validation of fin-rays for aging muskellunge;

12) Genetics Management Pan - The importance of genetic divergence among populations, stocks, and strains of muskellunge has long been recognized (Hanson et al. 1983; Hanson et al. 1986; Hanson 1986; Koppelman and Phillipp 1986; Wingate 1986; Fields et al. 1992; Younk and Strand 1992). In addition to the performance differences observed among populations, there are at least three morphological "types" or races of muskellunge throughout their native range that have, at various times, been recognized as distinct subspecies of muskellunge (Becker, 1983). This level of morphological variability implies significant genetic divergence among populations of muskellunge throughout its native range, at multiple spatial scales. Understanding the spatial structure and stock composition of muskellunge populations is essential for their sustainable management. To that end, Murphy (2009) and Spude (2010) recently identified genetic divergence among inland muskellunge populations in Wisconsin, coinciding with major drainage basins of the state. Subsequently, Kapuscinski et al. (2013) found significant spatial structuring of muskellunge populations within the Great Lakes. Further, Wilson et al. (2016) found that Muskellunge had substantial spatial genetic structure within Lake Huron and Georgian Bay. Thus, intraspecific genetic variation associated with the existence of stocks can be found within and among major river drainages.

Musky Team Charge

1. Develop/review regulation guidance and proposals;
2. Develop/review stocking guidance and plans;
3. Develop/review habitat management guidance;
4. Develop/review sampling protocol and assessment methods;
5. Review/update musky plan; assess status of the fishery;
6. Identify research needs; coordinate evaluations;
7. Maintain/update musky waters classification system.

Annual Work Plan Objectives for 2017-18: 1) Transition all the 28" minimum length limit waters to either "No minimum" or the statewide 40" minimum (by 2020); 2) explore the development of a harvest registration system for muskellunge via an advisory question (2019 hearings); 3) implement the spawning habitat model/generate a GIS layer of "high-probability" spawning grounds; 4) increase the application of the Sensitive Area Designation program; 5) Finalize a Genetics Management Plan for muskellunge (early 2018); 6) Initiate research on spawning/rearing habitat enhancement; 7) Begin to examine ways to increase the size of stocked fingerlings, e.g., evaluate stocking densities in ponds,

extended rearing, etc.; 8) Resolve the issue of rearing muskellunge on dry food at Wild Rose hatchery; 9) Finalize PIT tagging procedures, gain approval from FMPT and incorporate in the FM Handbook (by early 2018); Determine recurring PIT tag needs and coordinate statewide purchases for all species get the best price possible (2018); 10) evaluate alternative brood stock lakes in the native range (by 2020); 11) finalize publication of the proceedings of the Hugh Becker Muskellunge symposium (early 2018).

Southern Division

Kentucky

Prepared by: Kevin Frey, Tom Timmerman, Eric Cummins, and Jay Herrala

Increased paddle craft usage and a recent (2015) reciprocal fishing license agreement on the Tug Fork River (borders Kentucky and West Virginia) has spawned a 5-year muskellunge stocking agreement and evaluation of the developing muskie fishery. The first stocking was in October of 2017. KDFWR & WVDNR fisheries staff have already received positive feedback (phone calls & photos) of muskellunge catches from the Tug Fork.

A return to a 40-inch size limit is planned for Buckhorn Lake (1,230 acres; Eastern KY) in 2019. The size limit was lowered to 36 inches in 2010; however, angler and electrofishing catch rates have suffered due to a perceived overharvest and non-reporting of such during the most recent creel survey. Buckhorn Lake receives the "standard KY" muskie reservoir annual stocking rate of 0.33 fish/acre.

Assessment of a 36-inch size limit on Kentucky's reservoir muskie populations (Cave Run, Green River & Buckhorn); initiated in 2010, is ongoing through 2018. Enigmatic sampling efforts at Green River Lake have confounded this assessment, as late winter to early-spring diurnal electrofishing samples no longer yield reliable catch rate data. Thankfully, creel data indicates the Green River Lake muskie fishery remains similar or better in terms of angler catch rates (18.4 hours/fish > 36 inches) and angler attitude assessment/satisfaction prior to the regulation. Changes in the Green River Lake operation scheme (discharge and winter pool level) and the addition of alewives offer a multitude of possibilities for changes in muskellunge behavior. Spring fyke netting and nocturnal electrofishing will continue to be explored as possible solutions for sampling woes at Green River Lake.

Assessment of river and stream muskellunge populations is also ongoing to obtain a baseline data set to examine stocking rates, growth, mortality, natural reproduction and angler use. Natural reproduction of muskellunge has been noted on several tributaries of the North and Middle Forks of KY River in eastern KY.

North Carolina

Prepared by: Scott Loftis

Floodplain Connectivity and Muskellunge Spawning Habitat Restoration
North Carolina Wildlife Resources Commission Update
19 January 2018

Restoration of a 110-acre floodplain tract in Henderson County, North Carolina, located adjacent to Mud Creek and its confluence with the French Broad River (-82.531715; 35.401359), will target floodplain connectivity and spawning habitat restoration for Muskellunge. Acquisition of the property by Conserving Carolina occurred in 2016. Restoration of the tract is important because of its location, and because of the impacts agricultural use has had on water quality and hydrologic function of the river and adjacent 303(d) listed Mud Creek. Historic aerials show the entire tract was land cleared and farmed

prior to the 1920's. Restoration will focus on halting the erosion and sedimentation and restoring natural habitats. Spawning habitat of Muskellunge, a native sportfish, will be a component of this floodplain restoration project.

The floodplain tract provides an excellent opportunity for enhancing off-channel spawning habitat for Muskellunge. Although the French Broad River is free-flowing throughout most of its length in western North Carolina, it has lost much of its historical floodplain connectivity to ditching and draining for agriculture and development uses. The project area has numerous man-made ditches that will be modified to create small sloughs, oxbow ponds and tributary channels that will re-connect the river channel to the floodplain at a variety of water levels, creating spawning and nursery habitat for Muskellunge.

Three Muskellunge spawning habitat zones (4.1 ac, 3.1 ac and 2.5 ac) are included in the restoration design. Existing ditches and depressions will be excavated down to an elevation of 2,038.00 ft with gentle 3:1 side slopes that transition to a 10:1 side slope at the estimated mean spring water surface elevation of the French Broad River. The bottom of the Muskellunge spawning zones will be graded flat. The French Broad River water surface elevation ranges from 2,040.75 ft to 2,041.50 ft during the peak spawning months of March and April. With the proposed bottom elevation of 2,038.00 ft, the water depth in the restored spawning areas will vary from 2.5 ft to 4.0 ft deep. These spawning areas are designed to remain inundated year-round. Large Woody Debris and submergent native vegetation will be applied to the spawning areas for cover and substrate enhancement during site restoration.

Although native to the French Broad River basin, Muskellunge reproduction has suffered from decades of land use activities that have altered river functions and significantly limited historic spawning features. The North Carolina Wildlife Resources Commission has supported this popular fishery since the late 1970's through fingerling stockings. Numerous mark and recapture surveys along with other sampling efforts during the past 20-30 years have uncovered little to no natural reproduction, although trophy sized adults are routinely encountered. Large floodplain connectivity and spawning habitat restoration projects such as the one planned along the French Broad River provide an exciting opportunity to monitor the use and success of Muskellunge spawning in this much-needed habitat component.

Maryland

Prepared by: Josh Henesy, Matt Sell and John Mullican

The upper Potomac River supports Maryland's only muskellunge fishery, one supported entirely by natural reproduction. The muskellunge fishery is specifically targeted by a growing group of anglers. The Maryland Department of Natural Resources (MD DNR) Freshwater Fisheries Program has been monitoring the muskellunge fishery through biannual, non-targeted electrofishing surveys, a volunteer angler diary, and a muskellunge tagging program.

Since the tagging program started in 1997, over 750 muskellunge have been tagged with a total recapture rate of roughly 40%. Scales collected from 147 muskellunge (2008-2017) were used to generate sex specific length-at-age models. Female Potomac River muskellunge reach the 36" minimum size in 5.3 years, while males reach the minimum length in 5.5 years. The largest known muskie from the Potomac River were females measuring 50.5" and 49" (1282mm and 1244mm). Dr. John Casselman (Queen's University, Ontario) estimated the age of both of these fish at 17 years by examining the sectioned cleithrum. The 49" fish was caught by an angler in May, 2017 and is now the new Maryland State Record at 32.5lbs. Catch curve regression of age 5 and older muskellunge estimated total annual mortality at only 22 percent.

The volunteer angler diary program began in 2009 to obtain information on recreational effort, catch, and harvest. The average catch rate over the past five years (2012-2016) was 11 hours/fish. Muskie anglers participating in the creel diary program voluntarily released 100 percent of the muskie caught; the voluntary release rate based on tag return data was 97 percent, demonstrating very high overall release rates. Angler catch rates were highest in July, corresponding to higher water temperatures in the river and muskellunge moving and concentrating in thermal refugia.

A radiotelemetry project was initiated in March of 2017 with three primary objectives: 1) Document seasonal movement and habitat usage specific to the freshwater Potomac, 2) Determine muskellunge reliance on thermal refugia during summer months when mainstem temps reach or exceed 25°C, and 3) Determine fishing/release mortality; specifically catch and release mortality during periods of thermal stress. Seasonal movement and habitat use were consistent with existing literature for lotic systems. All of the tagged fish (N=13) were found using thermal refugia when river temperatures reached and/or exceeded 25°C. Additional radio transmitters were purchased through the Hugh C. Becker Grant (Muskies Inc.) for 2018 and the project will extend into 2020 with a focus on thermal refugia and angling impacts during periods of thermal stress.

Virginia

Prepared by: Dan Goetz and Jason Hallacher

James River

Prepared by: Dan Goetz

- Catch rates of adult muskellunge continue to increase on the James River. Abundance has increased from less than 1 fish/hr of boat electrofishing in 2000 to currently over four fish/hr (Figure 1).
- There are no plans to stock the James River in the near future. We will continue to monitor abundance to ensure natural reproduction is sufficient to sustain the population.
- Natural recruitment is still being detected but has been minimal since the increase in adults. We have linked recruitment to the abundance of adults in the river in conjunction with spring flow conditions. We anticipate seeing minimal recruitment in the next few years assuming adult abundance remains high. Currently over 20% of all fish captured via electrofishing are 40” or larger (Figure 2).
- Age and growth analysis in 2014 suggested that muskellunge reach 40” around age 5 which is considerably faster than northern populations (Figure 3). However, the maximum age detected is eight, so it is unclear if mortality is a limiting factor in preventing growth of much larger fish. We plan to do another age and growth study in 2018 or 2019.
- Year two of four for the James River Muskie Exploitation study was completed in 2017. So far 472 Muskellunge have been tagged (211 in 2016, and 261 in 2017). Preliminary tag return data suggests between 25 and 60% catch rates annually. These estimates will be narrowed down at the end of the study when we have accurate angler response bias and tag loss estimates. Overall harvest levels are low < 5%, and some reported fish mortality following release.

- We have been pit tagging fish in the dorsal fin to help estimate reward tag retention and track movements. Fish for the most part are staying put. However, we have documented upstream movement up to 25km. Thus far, overall tag retention is greater than 92%.
- In 2016 we handed out 40 survey reward cards to estimate response bias. Of the 40 handed out only 19 (47.5%) were returned.
- Plans are in the works to conduct a summer catch and release mortality study and evaluate the population level impact on the James River in 2019. STAY TUNED!!!

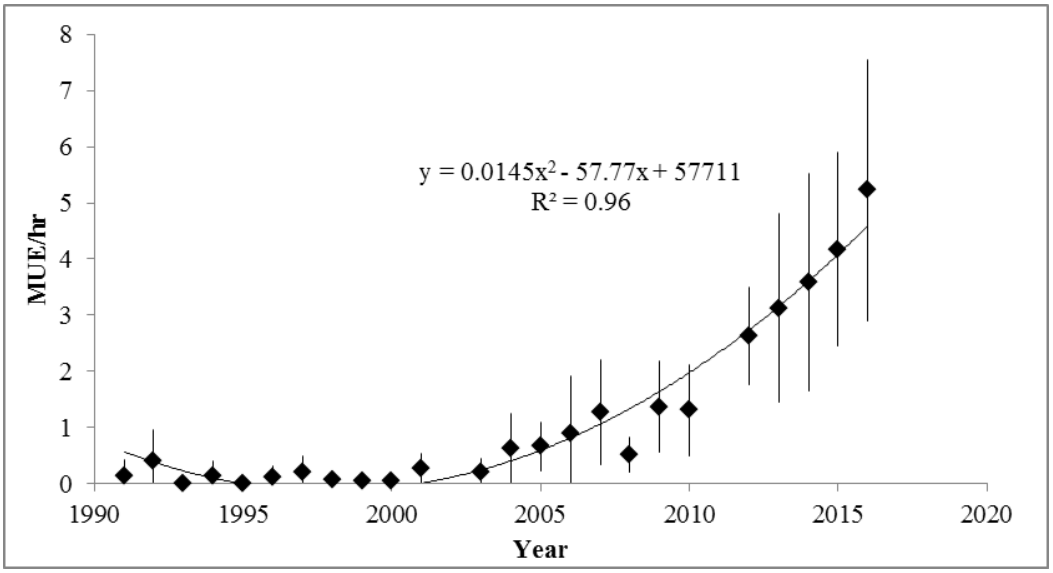

Figure 1. Annual relative abundance trends for muskellunge via boat electrofishing for James River, VA.

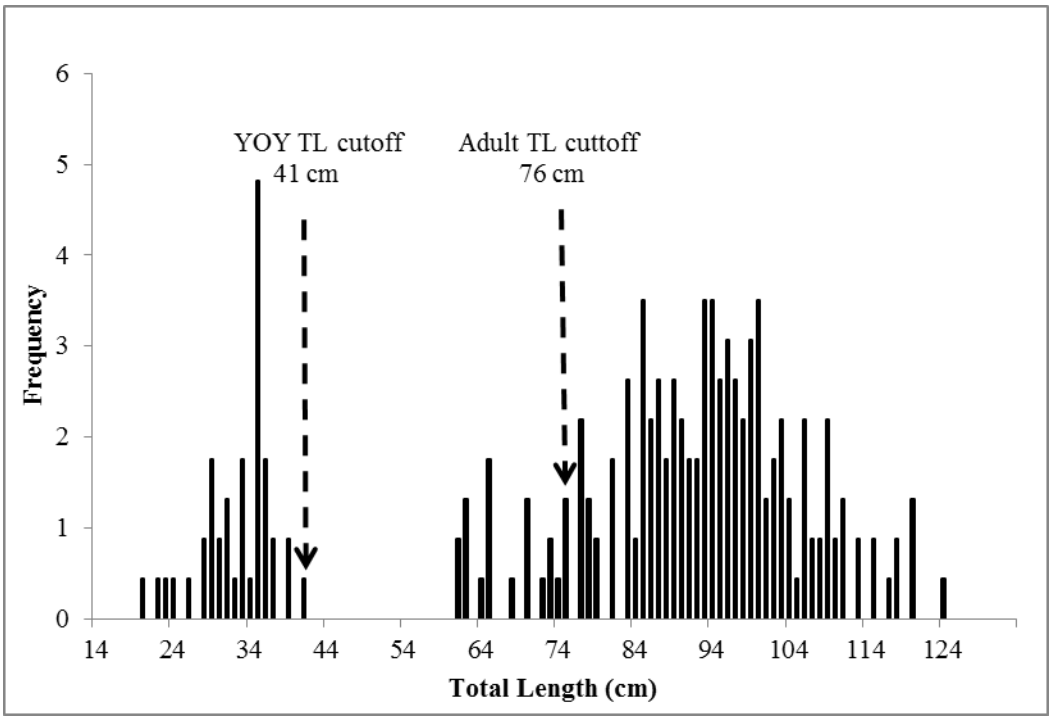

Figure 2. Length Frequency distribution for muskellunge collected via boat electrofishing.

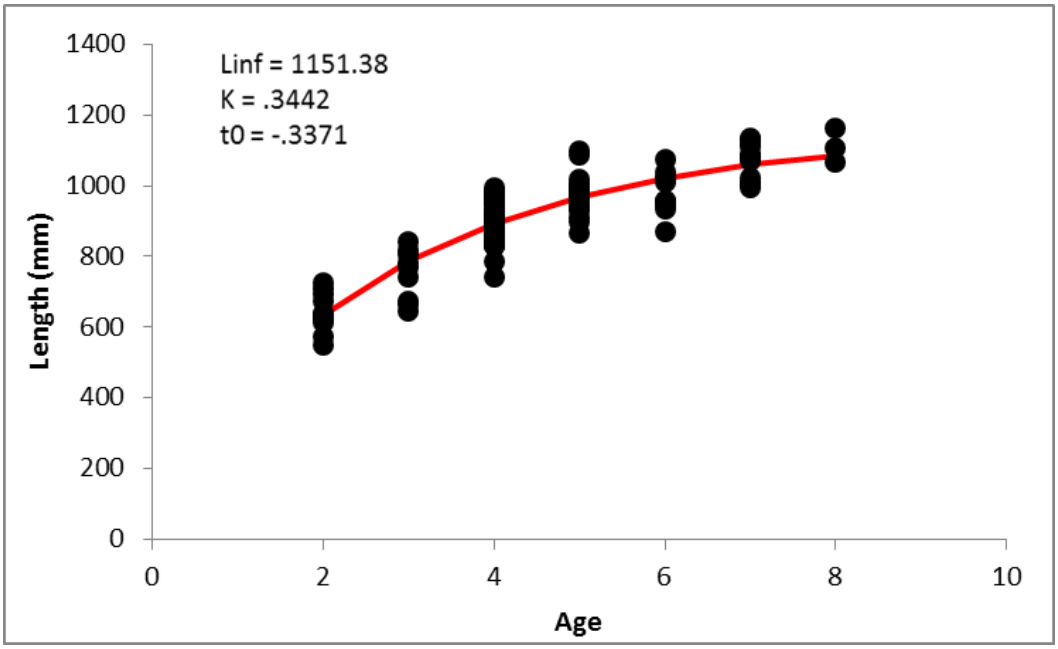

Figure 3. Length at age for muskellunge on James River with Von Bertalanffy Growth Parameters.

The Shenandoah River Muskellunge Project 2017
Prepared by: Jason Hallacher

- Intensive sampling continued in the spring of 2017 for muskellunge on the South Fork Shenandoah and Main Stem Shenandoah Rivers. Three electrofishing boats were used at 10 different sites. A total of 39 musky were captured at a rate of 1.6 fish per hour (CPUE). All fish were measured, weighed, and scanned for a Passive Integrated Transponder tag (PIT Tag) and a Coded Wire Tag implanted into the fish before stocking. The fish's dorsal fin was visually inspected for a Visual Implant Tag, and its dorsal musculature inspected for a floy tag. Floy tags were implanted in the dorsal musculature for anglers to recover. Informative posters were distributed at boat landings instructing anglers to report the length of the fish, location it was caught, floy tag number, and whether or not they harvested the musky. After the angler mailed in the tag he or she was rewarded $20. Our goal is to determine angler exploitation. Seven floy tags were turned in for a reward in 2017. Four out of 7 fish showed significant movement from the original tagging location. All fish were released by the anglers.
- The PIT Tags and Floy Tags will help us gain knowledge of the growth and movement of musky in the South Fork and Main Stem Shenandoah Rivers. Twenty-three of the 39 musky captured contained PIT Tags (59%). Movement was fairly static, but individual movement has been documented.
- From 2009 to 2014 Coded Wire Tags were injected into all musky stocked into the South Fork Shenandoah and Main Stem Shenandoah Rivers. No fish were stocked into the South Fork and Main Stem Shenandoah Rivers in 2015, 2016, or 2017 due to fingerling shortages. Tags were placed in the nape of the muskies in 2009, the dorsal fin in 2010, the caudal peduncle in 2011, the anal fin in 2012, the pelvic fin in 2013, and the pectoral fin in 2014. Tagging allows us to collect age and growth

data, determine if the musky are spawning in the wild, and verify how well our stocked fish contribute to the fishery. During spring sampling 16 of 39 muskies captured contained coded wire tags (41%).

- Lake Shenandoah was sampled in late March when lake temperatures reached 15 degrees Celsius. Four trap nets were used for a total of 8 net nights. Two musky were caught (0.25 CPUE).
- During the months of March and April, Region IV and Region II staff collaborated to collect brood fish from the James River in Lynchburg on two separate occasions. A total of nine females were collected (993-1300mm) and were injected (IC) with reconstituted Common Carp Pituitary gland at a rate of 6.6 mg/kg to induce spawning. Males were also collected. All fish were shipped to Vic Thomas Fish Cultural station and held in outdoor circular ponds for three days. Six out of 9 females provided eggs. 2-3 males were used to fertilize each batch. Fertilization success ranged from 29 – 96% one week after egg take. Over 100,000 fry hatched. From those 25,000 fingerlings were stocked into a pond at Buller Fish Cultural Station.
- In the fall of 2017 we failed to raise enough Musky to meet our statewide allocation. The South Fork Shenandoah River, Main Stem Shenandoah River, North Fork Shenandoah River, and Lake Shenandoah received no fish.

West Virginia

Prepared by: Jeff L. Hansbarger

- Listed below are the selected West Virginia waters stocked with muskellunge in 2018.

Stream	Number	Brood Stock	Date	Hatchery	Type
Burnsville Reservoir	?	WV origin	9/28/17	Falls Mill	AF
East Lynn Reservoir	139	WV origin	10/4/17	Bee Run	AF
North Bend Lake	100	WV origin	10/11/17	Palestine	AF
East Lynn Reservoir	118	WV origin	10/11/17	Palestine	AF
Woodrum Lake	100	WV origin	10/11/17	Palestine	AF
Kimsey Run	30	L. Chautauqua	11/1/17	Bowden	AF
Stonewall Jackson Reservoir	456	L. Chautauqua	11/1/17	Bowden	AF
Stonecoal Reservoir	165	L. Chautauqua	11/1/17	Bowden	AF
West Fork River	16000	L. Chautauqua	5/25/17	Palestine	Fry

Due to a valve issue with a hatchery pond that drains into Burnsville lake, Burnsville received an unknown number of advanced muskellunge fingerlings in 2017. The West Virginia Division of Natural Resources (WVDNR) stocked and PIT tagged this year's cohort of Lake Chautauqua strain advanced fingerlings into Stonewall Jackson Lake, Kimsey Run, and Stonecoal Reservoir. For the past four prior years every stocked cohort of WV origin fish into Stonewall Jackson was also PIT tagged. Over time this will allow us to determine differences in growth and possible maximum size. We have a number of anglers equipped with PIT tag readers who have assisted greatly with their recaps. One angler at Stonewall Jackson had 80 catches trolling in 2017 with 51 being tagged. This angler also commented that he did exceptionally well during the past solar eclipse, releasing 7 muskies ranging from 32" to 45" during the peak eclipse period - an exceptional day anywhere for any muskie angler.

- The evaluation of natural reproduction on the Mud, Guyandotte and Coal Rivers is going well with frequent angler reports of muskies below 30" indicating natural reproduction in those watersheds (we have ceased stocking since 2014). A number of exceptional catches in the 40-48" range have surfaced primarily in the Coal River this fall also. Due to hatchery problems, we chose now as a good time to evaluate natural reproduction in selected rivers while repairs were made. Most all repairs have been completed at the Palestine (Elizabeth, WV) and Apple Grove (Apple Grove, WV) State Fish hatcheries to date. A new water pump was installed at Palestine and a few ponds were re-dug and their walls strengthened at Palestine. Apple Grove State Fish Hatchery had all pond liners replaced and the main reservoir's wells and pumps are working correctly now. The work at Apple Grove alone totaled over $3.2 million.

- The West Virginia club/chapter banquet circuit is in full swing. These are great events to go to, excellent food, fellowship, local lure vendors and raffles at most. Below is a listing of events:

  Elk River Club Banquet January 20 Clendenin WV
  Elk River Expo (vendors, educational seminars, fellowship) February 3 Clendenin WV
  Battle of the Virginias Tournament Banquet February 10 Ghent WV
  Muskies Inc, Chapter 9 Banquet March 10 Harrisville WV Community Center
  WV Husky Musky Club Banquet March 17 Burnsville WV Community Center
  Muskies Inc Chapter 63 March 17(?) Big Otter WV Community Center (may change)
  Trooper Eric Workman Foundation Memorial Tournament June 2018

- Based on a cooperative hand-shake agreement, the WVDNR and the Kentucky Department of Fish and Wildlife Resources (KDFWR) will share muskellunge stocking duties to increase muskellunge numbers in the Tug Fork, a shared border river between KY and WV. Kentucky Department of Fish and Wildlife Resources (KDFWR) initiated this effort in 2017 by stocking 100,000 spring released fry, and close to 500 fall released advanced fingerlings. Within three days of the fall stocking, two angers had caught and released two of the "jumbo" fingerlings from 14-16" on spinning gear, quick returns to KDFWR's stocking efforts. Both states also share a reciprocal fishing agreement on the Tug Fork. Muskies are reported downstream in the Big Sandy and a KY tributary the Levisa Fork. In the past, the WVDNR has also stocked the headwaters of the Tug Fork periodically which begins in southern West Virginia. Future goals include surveys and angler feedback to gather evidence on stocking success. The WVDNR plans to improve access on the WV side of the river as well. A recent Tug Fork Water Trail meeting was held in Matewan, West Virginia to gather interest in developing the river as a designated Water Trail. In the past, this river was severely impacted but great strides have been made in improving water quality.