Poster Presentations

Precision of Otolith and Dorsal Spine Age Estimates for Walleye Sander vitreus in Northern Lake Michigan

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Abstract-Northern Lake Michigan supports the largest recreational fishery for Michigan's Upper Peninsula, with Walleye *Sander vitreus* being a popular species during the majority of the year. Effective management of this Walleye population requires accurate and precise age estimates to understand recruitment, growth, and mortality rates. Precision of ages estimated from dorsal spines and otoliths was evaluated to assess current age estimation protocols of the Michigan Department of Natural Resources. The objective of this study was to determine if age estimates and between-reader precision differed between dorsal spines and otoliths for Walleye in four locations of Green Bay: Big Bay de Noc, Little Bay de Noc, and two tributaries, the Menominee and Cedar rivers. Walleye were sampled during August-September 2015 with gill nets and trawls; ages were estimated from dorsal spines and otoliths by two independent readers. For both structures, reader agreement was generally high, and age estimates were typically within one year if there was not exact agreement. When analyzed collectively, there was a significant difference in between-reader precision for the Bays de Noc. However, when analyzed individually, significant differences were only observed for Little Bay de Noc. In comparison, no significant differences in between-reader precision were observed for the rivers, whether analyzed collectively or individually. Overall, dorsal spines had slightly higher precision than otoliths, but underestimation of otolith age was observed for dorsal spines from older Walleye. Age distribution among locations may be the cause for the observed differences in precision. Our results suggest that otoliths should be considered for estimating the age of large, older Walleye, but additional assessment is needed.

Evaluating Methodologies for Estimating Age and Growth of Lake Sturgeon (Acipenser fulvescens)

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Abstract- Pectoral spines have been the preferred aging structure for estimating age of Lake Sturgeon (*Acipenser fulvescens*), as well as other sturgeon species. However, age estimates from pectoral fin spines for Lake Sturgeon from the Winnebago System, Wisconsin, underestimate the age of fish over the true age of 14. Age interpretations from otoliths were reported as validated (Bruch et al. 2009), but difficulties in otolith availability, collection, and processing have resulted in little to no reported comprehensive work with Lake Sturgeon otoliths since 2009. Our research, will evaluate four different techniques for estimating age and growth rates of Lake Sturgeon including: use of pectoral fin spine sections, application of a correction factor assigned to pectoral fin spine age estimates (Bruch et al. 2009), otolith cross sections, and the Fabens (1965) and Wang (1998) growth model. Pectoral fin spine and otolith age estimates from known-age Lake Sturgeon (ages 4-15) will be used to re-assess accuracy of age estimates for juvenile fish, while a broader suite of methodologies including will be applied to age and growth data collected from older fish. Recent experimentation with otoliths using a thicker cross section followed by sanding and polishing has yielded some promising results.

Preliminary Assessment of Walleye, Lake Whitefish, and Yellow Perch Diets in Green Bay

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Abstract- Lake whitefish, walleyes, and yellow perch support some of the most important fisheries in Green Bay, but managers have limited information on how these three species interact in terms of predation and diet overlap. In 2016, we initiated a collaborative effort to gain more information on diets and potential interactions among these three species. To this point, we have examined diets from 298 walleye, 205 lake whitefish, and 189 yellow perch collected in Wisconsin DNR gill nets placed in 3 locations during the spring and from a few Wisconsin DNR electrofishing runs conducted in the fall. Round gobies have represented the most common prey item observed in walleye and yellow perch diets, while benthic invertebrates have dominated lake whitefish diets. Additional prey items we have observed with some regularity include rainbow smelt and gizzard shad in walleye diets, isopods in yellow perch, and round gobies in lake whitefish diets. Our current sampling has been limited in time and space, so additional work will be needed to better describe diets of these three fish.

Distribution, prevalence, and intensity of gill lice *Salmincola edwardsii* in Brook Trout in Wisconsin streams

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Abstract- Gill lice *Salmincola edwardsii* are ectoparasitic copepods that infect Brook Trout *Salvelinus fontinalis*. Both are considered indigenous to Wisconsin. In recent years, anglers reported catching more Brook Trout infected with gill lice in more streams. An epizootic of gill lice in Ash Creek, Wisconsin in 2012-2014 was implicated in a decline of 77-89% in age-0 Brook Trout recruitment. These events raised concerns about the frequency and magnitude of gill lice epizootics and their potential effect on Brook Trout in other Wisconsin streams. In 2013-2016, Brook Trout were inspected in 214 streams across Wisconsin to determine the state-wide distribution, prevalence, and intensity of gill lice infection. Gill lice were considered absent if 15 or more Brook Trout were inspected and all were uninfected. Gill lice were present in 82% of streams and absent from 18%. Prevalence of infection ranged from 0.4 to 100%. Intensity of infection of the most heavily-infected Brook Trout observed in a stream was light (1-5 gill lice) in 36% of streams, moderate (6-14) in 35%, and heavy (ï‚³15) in 29%. Intensity was heavy and prevalence exceeded 90% of Brook Trout in 3 of 214 streams, which suggests epizootics as observed in Ash Creek are uncommon.

Using Models for Tag-Recapture Data to Assess Growth of Bluegill and Largemouth Bass in Inch Lake, Wisconsin.

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Abstract- Inch Lake is a 31-acre soft-water seepage lake managed with no-harvest and artificial-lures-only regulations. The simple fish community of primarily Bluegill (*Lepomis macrochirus*), Largemouth Bass (*Micropterus salmoides*), and Bluntnose Minnow (*Pimephales notatus*) was sampled with fyke nets and by angling in May and June of 2006-2016. Bluegill larger than 125 mm and Largemouth Bass larger than 200 mm were marked with individually numbered Floy tags. The von Bertalanffy (Wang's parameterization), Gompertz, and logistic models can all be used to estimate growth parameters from length-at-tagging, length-at-recapture, and time-at-large data. The objective of this study is to explore the use of these models to describe the growth dynamics of Bluegill and Largemouth Bass in Inch Lake. The von Bertalanffy model best fit (using Akaike's Information Criterion) both the Bluegill and Largemouth Bass data. The sigmoidal Gompertz and logistic models may not have fit these data well because small fish with lengths below or at the inflection point were not sampled (i.e., were not tagged). Bluegill growth was considerably above the average for Bluegill populations in northern Wisconsin until approximately 200 mm, was near the average for these populations after 200 mm, and reached an asymptotic mean length (L_∞) of 256 mm. Growth of Largemouth Bass was considerably below the average for Largemouth Bass populations in northern Wisconsin for all observed lengths, was very slow after 300 mm, and had an asymptotic mean length of 342 mm. These results suggest strong density-dependent responses for both species where intra-specific competition and lack of suitable forage may limit growth of Largemouth Bass and a release from competition may result in good growth of Bluegill.

Genetic Origin of Walleye Stocked in the Manitowish Chain of Lakes, Vilas County, WI

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Abstract- The Manitowish Chain of Lakes is a renowned walleye fishery consisting of 10 connected lakes located in Vilas County, WI. In an effort to augment walleye numbers in the Manitowish Chain, a local private organization stocked 35,420 large fingerlings (mean = 6.9 inches). All lakes in the chain were stocked with up to 10 fingerlings per acre and the chain total stocking rate was 8.3/acre. The fingerlings were from a private hatchery in Minnesota with a declared northern Wisconsin strain of origin. Our objective was to determine the genetic origin of the walleye fingerlings stocked into the Manitowish Chain of Lakes during the fall of 2016. A total of 140 walleye tissue samples from 4 separate stocking events were genotyped at a standard suite of nine microsatellite loci. We used a reference dataset containing 2,026 walleye from 11 Minnesota and Wisconsin strains and the programs ONCOR and STRUCTURE to test the origin of the stocked fingerlings. Individual assignments determined that 0% of the fingerlings stocked into the Manitowish chain of lakes were from a genetic strain native to Wisconsin, and more than 96% assigned to a genetic strain similar to Lake Vermilion, MN in the Hudson Bay drainage.

A comparison of structures used to age channel catfish from the Wisconsin River

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Abstract- In Wisconsin, the age of channel catfish, *Ictalurus punctatus*, has been determined using multiple techniques. Most common has been the removal of the pectoral spine by clipping or sawing at the body wall, here referred to as a cut spine. The preferred method described in the literature has been the use of a section of the articulating process portion of the pectoral spine. This is recommended because age determination using a cut spine may be affected by erosion of the central lumen portion of the pectoral spine. In this study we use channel catfish samples collected from the Wisconsin River near Stevens Point, Wisconsin. Sample preparation is described for cut spine, articulating process, and otolith sections, and bias estimated among these structures. We also estimate bias between two readers for each structure.

Genetic Contribution of Leech Lake Muskellunge in Lake Wissota, WI.

Keith Turnquist, Wisconsin Cooperative Fishery Research Unit
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Abstract- Lake Wissota is a "Trophy" (Class A1) Muskellunge fishery maintained though stocking native upper Chippewa River strain Muskellunge by the Wisconsin Department of Natural Resources. However, in an attempt to increase the size structure of Muskellunge, private organizations initiated several stocking events from 2005-2015 of a different genetic strain (the Leech Lake strain) into Lake Wissota. During this period, nearly 25% of the Muskellunge stocked in Lake Wissota were Leech Lake strain. Our objective was to determine the genetic origin of Muskellunge in Lake Wissota, WI. Tissue samples from 156 Muskellunge were collected in 2015-2016 and genotyped at a standardized suite of 13 microsatellite loci. Strain assignment of each fish were compared to reference populations from two native Wisconsin strains and the Leech Lake strain using a Bayesian approach in the program STRUCTURE. Approximately 95% of the Muskellunge (N=148) were identified as Wisconsin strain, four fish (2.5%) were identified at Leech Lake strain, and four fish (2.5%) were identified as putative hybrids between the Wisconsin and Leech Lake strains. The results indicate that Leech Lake strain Muskellunge survive in Lake Wissota at a lower proportion than the stocking rate, and natural reproduction including hybridization between strains has occurred.

An Historical Comparison of Lake Superior Sea Lamprey Fecundity and Egg Characteristics

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Abstract- The fecundity of Sea Lamprey (*Petromyzon marinus*) in Lake Superior was last studied in 1960. Since then, Sea Lamprey populations in Lake Superior have declined, largely due to continual control efforts. Our objective with this study is to determine if Sea Lamprey fecundity and egg characteristics have changed from 1960. We collected 35 Sea Lamprey from the Bad, Brule, and Middle Rivers in northern Wisconsin in May, 2016. Total length (TL; nearest mm) was measured for each individual and the ovaries were preserved in 10% formalin. Eggs counted from three 0.5 g subsamples were expanded by the total weight of the ovary to estimate the total number of eggs in each ovary. Ten eggs from each subsample were measured from digital images and pooled to find a single average egg diameter for each fish. Similar data from 29 Lamprey sampled from the Chocolay River (MI) in 1960 were obtained from Manion (1972; Trans. Am. Fish. Soc. 101:718-720). Indicator variable regressions were used to examine the effect of sampling location (i.e., river) on the relationships between fecundity or average egg diameter and TL. Fecundity increased slightly with increasing TL, but the relationship between fecundity and TL did not differ among the four rivers. No relationship between TL and average egg diameter was detected, but larger average egg diameters were observed for fish from the Brule and Middle Rivers. Thus, fecundity of Sea Lamprey in Lake Superior does not appear to have changed since 1960. Average egg diameter may have increased since 1960, but this conclusion is tentative given that results from some modern locations did not differ from the historic results.

Application of the Parameter ω Derived from the von Bertalanffy Growth Equation for Walleye in Escanaba Lake, Wisconsin

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Abstract- The von Bertalanffy growth equation has been widely used to describe and compare growth patterns in fishes. Although the model provides a reasonable estimate of asymptotic length, its value in understanding life history processes has been questioned. As an alternative, Gallucci and Quinn (1979) proposed that a new parameter, $\omega = K*L_\infty$, be used for testing hypotheses between characteristics of early growth. Estimated as a rate, ω is thought to be a better representation of early growth compared to K and correspond to the instantaneous rate of growth in the vicinity of t_0 (age at which length = 0). Despite the use of ω, this parameter and its properties have not been evaluated empirically. To test for a biological correlation between Ï‰ and in-situ juvenile Walleye Sander vitreus growth rates, we used an extensive data set for Walleye from Escanaba Lake, Wisconsin. This data set allowed us to fit the von Bertalanffy growth equation using traditional (fish age and length data collected from a single lake-year) and cohort methods (single year class across multiple lake years). When K, L_∞, and ω were estimated by the traditional method, we found no correlations with age-0, age-1 and age-2 Walleye growth rates. When estimated using the cohort method, ω and K were positively correlated with age-0 and age-1 Walleye growth rates; however, the correlation coefficient for K was greater. Our results suggest that ω has limited utility for informing fisheries managers of juvenile Walleye growth when calculated by the traditional method, as ω does not relate to observed juvenile Walleye growth rates. ω may still have beneficial uses for comparing growth characteristics among populations, but should not be interpreted as a biologically meaningful early growth rate.

Evaluation of a Stocked Brook Trout Stream in Northern Wisconsin

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Abstract- The North Branch Pemebonwon (NB PBW) and the South Branch Pemebonwon (SB PBW) form the Pemebonwon River, a tributary to the Menominee River. Since the 1950s, both the NB PBW and SB PBW have been stocked annually with yearling brook trout. In 2014 and 2016, fin clipped (adipose) yearling brook trout were stocked in both the NB PBW (6,000 and 5,000, respectively) and SB PBW (5,500 and 4,600, respectively). The NB PBW and SB PBW were surveyed following WDNR's monitoring protocol for Tier I coldwater, wadeable streams. Electrofishing surveys took place 6 to 12 weeks post stocking at on the NB PBW (8 sites) and SB PBW (13 sites). In 2014, 11% of the brook trout collected (over 5.0 inches total length) in the NB PBW had an adipose fin clip while 30% of those collected in the SB PBW were fin clipped. In 2016, 18% of the brook trout collected (over 5.0 inches total length) in the NB PBW had an adipose fin clip while 22% of those collected in the SB PBW were fin clipped. In both years, the percentage of fin-clipped brook trout at stocking sites ranged from 4 to 78% but from 0 to 56% at non-stocked sites. Overall, stocked brook trout significantly contributed to the fishery of each stream based on the number of recaptures in both years. Previous year's stocking of yearling brook trout likely did not influence our results since the mean length at capture of marked fish was the same between years and relatively similar to the mean size at stocking. This data will help guide future fisheries management activities and help optimize the use and placement of stocked brook trout in both streams.

Larval fish monitoring in the Upper Mississippi River Pools 8-13: surveys for emerging populations of Asian carps in novel habitats

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Abstract- Evaluation of population and reproductive dynamics of Asian Carps in the Upper Mississippi River (UMR) provides timely detection of new spawning events, can identify novel spawning and nursery habitats, and allows managers to formulate effective strategies for controlling emergent populations. The primary objectives of this monitoring program are to evaluate Asian Carp reproduction (egg, larval, and juvenile densities) and recruitment patterns in the Upper Mississippi River Watershed. A secondary objective of the proposed program is to monitor larval fish and egg production of native fishes. Monitoring eggs and larvae using ichthyoplankton tows was conducted at 28 fixed-locations in the UMR approximately every 2 weeks during summer 2016. 5,242 larval and juvenile fish and 3,659 eggs were collected in 240 ichthyoplankton tows conducted between 11 May and 31 August 2016. In the laboratory, eggs and larvae were separated from detritus, counted, and preserved for vouchering and, if necessary, genetic identification. Initial visual evaluations of larval and juvenile fishes did not identify any Bighead or Silver Carps in the samples, but these identifications will be verified via molecular techniques during spring 2017. Yearly monitoring of larval fish and egg drift in the Upper Mississippi River and its tributaries offers opportunities to explore the reproductive habits of fishes aside from Asian Carps. Additionally, these data allow development of a baseline, pre-invasion estimate of native fish production/recruitment in rivers where Asian Carps have likely not yet established robust reproductive populations.

Prototype R Function for Computing the Lyons et al. (2001) Wisconsin Large-River IBI

Joseph Mrnak, Wisconsin DNR
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Abstract- An index of biotic integrity (IBI) provides fishery professionals a single value to rapidly assess aquatic communities and evaluate restoration efforts within those communities. An IBI accounts for the structure, composition, and functional organization of the biological community. To address the difficulty of characterizing fish assemblages in larger rivers, coupled with a lack of undegraded reaches used to estimate expected conditions, Lyons et al. (2001; Transactions of the American Fisheries Society 130:1077-1094) designed an IBI for Wisconsin's large rivers. We developed a prototype R function for computing IBI scores for Wisconsin's large rivers from the description in Lyons et al. (2001). Inputs to the function are counts and weights of individual fish, aggregate counts and weights for non-game fish, and total effort expended on the survey, all of which are retrieved from the Wisconsin Department of Natural Resources Fisheries Management Database. The function returns the overall IBI score, summary tables and plots of the input data, and specific IBI metric scores. Our objective for this poster is to 1) demonstrate the function prototype and 2) garner comments, critiques, and suggestions for improving the function interface and results.

Age Validation of Brown Trout in Driftless Area Streams in Wisconsin Using Otoliths

Justin Haglund
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Abstract- Accurate and precise age estimation is crucial to understand fish population dynamics and manage fish populations. In this study, we used otoliths to validate the absolute age of Brown Trout *Salmo trutta* in four Driftless Area streams of southwestern Wisconsin. Age-1 Brown Trout were tagged with coded wire tags during spring in 2010-2015. Recaptured known-age trout were later collected for ageing. Otoliths and coded wire tags were extracted from 249 Brown Trout ages 1-5 and aged by three independent readers. Complete agreement (agreement by all readers) was 74%, partial agreement (agreement between at least two readers) was 98%, and consensus agreement (agreed upon age by all readers) with known age was 93% with a coefficient of variation of 9.4%. Consensus agreement by age varied from 81% for age 3 (n=31) to 98% for age 1 (n=132) and 100% for age 5 (n=6). We conclude that otoliths provide an accurate method for ageing Brown Trout in Wisconsin's Driftless Area streams and results from this study may guide future Brown Trout ageing efforts in other productive inland riverine systems.

Influence of Prey Community on the Growth and Body Condition of Lake Trout in Northern Minnesota Lakes

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Abstract- Lake Trout *Salvelinus namaycush* are primarily piscivorous when deepwater forage fish are available, and non-piscivorous when that prey is lacking. Piscivorous Lake Trout often rely on Cisco *Coregonus* spp. as prey, so the decline and extirpation of Cisco populations in many lakes may negatively influence Lake Trout growth and body condition. Therefore, the objectives of this study were to determine if growth and body condition differed between piscivorous and non-piscivorous Lake Trout populations. Lake Trout were collected during standard gill net assessments in 2011-2014 from six lakes (three piscivorous, three non-piscivorous) with naturally occurring and self-sustaining populations in northern Minnesota. We back-calculated total length (mm) from scales and quantified individual growth rates and body condition (relative weight) in all lakes. Von Bertalanffy growth models showed much higher growth potential (i.e., larger L_∞) for piscivorous populations. In addition, back-calculated length at age-7 was significantly greater ($F = 3.583$, $p = 0.041$) in piscivorous (mean = 433.76 mm) compared to non-piscivorous (mean = 415.42 mm) Lake Trout. Piscivorous Lake Trout began to show larger increases in annual growth increments at age-5, revealing a possible ontogenetic shift to piscivory. All populations had healthy body conditions (mean relative weights > 98), but individual body condition tended to increase with total length for piscivorous populations and decline for non-piscivorous populations. Overall, piscivorous Lake Trout grew larger and displayed better body condition than non-piscivorous Lake Trout, highlighting the importance of deepwater forage such as Cisco.

Genetic origins and movements of Lake Sturgeon in the St. Louis River

Justin VanDeHey
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Abstract- The St. Louis River (SLR) historically supported Lake Sturgeon *Acipenser fulvescens* but by the early 1900s Sturgeon were extirpated. Exploitation was nearly eliminated and water quality and habitat improvements lead to joint efforts by Minnesota and Wisconsin Departments of Natural Resources to re-establish Lake Sturgeon. Lake Sturgeon from Wolf River strain (Lake Michigan drainage) were stocked in the SLR from 1983-1994. Lake Sturgeon from the Bad (1988) and Sturgeon rivers (1998-2000), Lake Superior sources, were also stocked into the SLR. Recently, natural reproduction has been documented, however questions exist regarding the genetic origins of spawning fish. Our objectives were to determine (1) the genetic origin of Lake Sturgeon collected in the SLR and (2) if Lake Sturgeon remain in the SLR throughout the year or emigrate into Lake Superior. During spring 2016, 249 adult Lake Sturgeon ranging from 82 to 165 cm in length were collected in the SLR using electrofishing. Genetic tissues were collected from all fish and a total of 45 Sturgeon received an acoustic tag. Genetic strain was assessed using 10 microsatellite loci standardized across Great Lakes populations. All 45 acoustic tagged Lake Sturgeon collected in the SLR genetically assigned as Wolf River strain. Forty-three of 45 tagged fish were detected at least once on fixed-receivers. Twenty-nine of 43 detected Sturgeon emigrated into Lake Superior, primarily during June and September. Fourteen fish did not emigrate suggesting a resident and migratory population. Knowledge of genetic composition and movement patterns will aid in management of this species of concern.