

2021 Wisconsin AFS Annual Meeting
Abstract Submission – Posters

Title: Field Evaluation of Muskellunge Movement and Dam Escapement

Author: Nathan Schimanski, *University of Wisconsin – LaCrosse*

Co-author(s): David Schumann

Abstract:

Muskellunge (*Esox masquinongy*) sport fisheries are popular throughout the Midwest, an area where anglers spend ~\$425 million annually targeting the species. Costly stocking efforts to bolster Muskellunge populations and provide additional angling opportunities are common throughout Wisconsin. Since 2006, 13,067 small and 8,007 large fingerling have been introduced to Lake Neshonoc, a 606-acre impoundment in southwestern Wisconsin. Angler anecdotes suggest that a number of these individuals escape the system and move throughout the La Crosse River. We described the relative abundance and size structure of stocked Muskellunge in the reservoir and downstream segments of the river. Only ~1% (n = 198) of the stocked fish have been captured in the reservoir during post-stocking standardized sampling efforts and a number of individuals have been captured in the La Crosse River (n = 119). Catch-rates initially increased in the reservoir after stocking started but have steadily declined since 2015. Conversely the relative abundance has increased considerably in the river since 2006 (mean $\pm$ standard error; before: 0, after: 1.39 ± 0.53 fish per mile). Although individuals have been observed, and tagged individuals have been recaptured in the river, the size structure has skewed slightly larger in the reservoir. Relatively large individuals (i.e., >1000 mm) have been captured in both systems. Moving forwards, we will describe the likelihood of escapement over the dam and describe the factors that influence Muskellunge movement behaviors. Relatively few fish have been captured in the reservoir, but it is currently not clear if this is because of low survival, large escapement events, or related to habitat availability in the reservoir. In order to address these hypotheses, we will tag stocked fish with acoustic tags and monitor their movements in the reservoir and river system using passive and directional receivers.

Title: Station Holding Endurance of Slimy Sculpin (*Cottus cognatus*) on Different Substrates

Author: Avery Lettenberger, *University of Wisconsin – LaCrosse*

Co-author(s): David Schumann

Abstract:

Coldwater streams in the Driftless region of Southwestern Wisconsin are sensitive to increased inputs of fine sediments that limit the interstitial space between larger substrates that are crucial to benthic fishes. Direct interactions from the transition of surrounding land for agriculture and projected increase of precipitation from climate change create a higher risk of sedimentation through overland flow. Sculpin (*Cottus* spp.) are adapted to anchor to large substrates in areas of high-water velocity to minimize energetic demands that could become less prevalent with increased sedimentation rates. We describe the influence of increased of fine sediments in coldwater streams on the swimming and station-holding abilities of Slimy Sculpin (*Cottus cognatus*). Slimy Sculpin swimming performance and station holding ability was measured in a

10-L Brett-type flume using the slip and burst methods introduced by Veillard et al. (2017). A pool of sculpin ($n = 70$) were tested in unembedded gravel or in gravel embedded with without replacement using an endurance protocol at constant velocity increments (i.e., 5, 10, 20, 30, 40, 50, 60 cm s⁻¹). Slip time was measured as the time of failure taken when the fish is impinged against the downstream grid for >10 s and burst time was the time when the fish first leaves the substrate to reposition or swim in the water column. A total of 35 sculpin will be tested in each substrate type, with five tested per velocity increment. Data collection is still ongoing and will be completed and analyzed in December 2021. Slimy Sculpin in the region are already under stressors as result of a changing climate and are preyed on by non-native Brown Trout (*Salmo trutta*) that are well researched. However, research focused on the risk of sedimentation on sculpin energetics are rare despite the potential negative population level effects. The distribution of Slimy Sculpin could be influenced by the landscape changes that alter sedimentation rates.

Title: **Brook Trout Movement and Habitat Use in the Little Plover River, Wisconsin**

Author: Keenan Foley, *University of Wisconsin – Stevens Point*

Co-author(s): Joshua Raabe, Jeremiah Shrovnal

Abstract:

Brook trout *Salvelinus fontinalis* are a native, sensitive apex predator and important sportfish in small cold-water streams. The Little Plover River in Portage County, Wisconsin provides a unique study system as brook trout are the only major apex predator, a dam isolates the system, and various in-stream and watershed restoration efforts have occurred in part to address extreme low flows associated with groundwater pumping. We used radio telemetry to evaluate brook trout movements and home ranges and to determine if individuals selected for particular habitat including recently restored reaches. We walked the river weekly from late June to late November in 2020 to locate and GPS mark tagged brook trout ($n=23$). Individual brook trout minimum home range over this timeframe was variable, ranging from 10-3613 m, and under 200 m for 52% of the individuals and under 1000 m for 78%. Spatial maps indicate system wide use, including restored reaches, drainage ditches, and headwaters, and increased movements associated with spawning. Across all observations ($n=188$), individuals were predominantly found in wood (63%) and predominantly over sandy substrate (75%). Our preliminary results indicate brook trout have variable home ranges, often use wood for cover, and that habitat projects should consider the entire system to account for individual movements, including upstream into very small channel for spawning.

Title: Effects of organic and inorganic fertilizers on freshwater mussel propagation

Author: Jarod Boyer, *U.S. Fish and Wildlife Service*

Co-author(s): David Schumann, Doug Aloisi

Abstract:

Unionidae mussel populations have declined throughout North America and now ~70% of species are considered at-risk of extinction. Conservation efforts for mussels have benefitted from artificial cultivation; however, these methods can be further refined for many species. Fatmucket (*Lampsilis siliquoidea*) are native to the Upper Mississippi River and are amenable to extensive culture. Propagation efforts for this and other species would benefit from pond fertilization schemes that support mussels and their fish hosts so long as suitable water quality is maintained. We compared Fatmucket production and size when reared in systems treated with organic (i.e., alfalfa) and inorganic (i.e., alfalfa, urea & phosphoric acid) fertilizers. Two 1.0-acre, aerated ponds were stocked with five cages, each with 30 Largemouth Bass (*Micropterus salmoides*), that were each inoculated with ~782 glochidia. Environmental conditions (i.e., pH, temperature, nutrients) were regularly monitored and the abundance of potential food particles was measured throughout the 15-week study period. Following the study, Fatmucket juveniles were recovered from both ponds (organic=16,907, inorganic=18,745) and measured to length. Environmental conditions varied little between the ponds, but there were more incidences of pH and unionized ammonia stress in the inorganic pond. Although the abundance of food particles collected ($F = 0.01$, $P > 0.05$), and number of Fatmucket recovered were similar in both ponds, the individuals in the organic pond were, on average, 25% larger than those from the inorganic pond (organic: 9.0 mm, inorganic: 6.8 mm). Freshwater mussel juveniles often prefer particles sizes $< 2 \mu\text{m}$ in size that were beneath study detection limits. It is unknown if the pond which was fertilized with organic fertilizer may have had a larger quantity of smaller particles that were not enumerated.

Title: Fish and Zooplankton Responses to the Cessation of Long-Term Invasive Eurasian Watermilfoil Chemical Treatments in a North Temperate Lake

Author: Ben Schleppenbach, *Wisconsin Department of Natural Resources*

Co-author(s): Greg Matzke, Stephanie Shaw, Greg Sass

Abstract:

2,4-D is a chemical commonly used to control invasive aquatic macrophytes, including Eurasian Watermilfoil (EWM). Effects of 2,4-D on non-target organisms are poorly understood; however, recent research has suggested the potential for lethal effects on certain fish species. Lake Ellwood, Florence County, Wisconsin was chemically treated with 2,4-D to control EWM annually during 2002-2012. Fish surveys following this chemical treatment period revealed natural recruitment failures of Bluegill and Largemouth Bass. We hypothesized that the Bluegill and Largemouth Bass populations had been negatively influenced by the chemical treatments. As a result, permits for additional chemical treatments were denied and we monitored the post-chemical treatment fish and zooplankton community responses during 2013-2019. Similar fish and zooplankton community data were collected from nearby Cosgrove (EWM absent) and Seidel lakes (EWM present, no history of chemical treatment) as reference systems. Fish

community analyses indicated strong, immediate increases in natural recruitment post-chemical treatment for Bluegill, Largemouth Bass, Smallmouth Bass, and Yellow Perch. Back calculation of year class strength for these species confirmed failed year classes during the chemical treatment period. Zooplankton community analysis indicated greater total zooplankton densities post-chemical treatment (2014-2016) compared to the reference systems and relative stabilization thereafter. Initial increases in the zooplankton community were most evident in cyclopoid copepods and copepod nauplii. Our results provide multiple lines of evidence to suggest that long-term 2,4-D chemical treatments may negatively influence fish and zooplankton through lethal and sublethal mechanisms. Thus, there remains a critical need for directed research on whole-lake chemical treatments, the timing and frequency of treatments, use of 2,4-D, and the spread and legacy of chemicals in waterbodies.

Title: Diet Analysis and Effects of Riparian Habitat Disturbance on Brook Trout in the Little Plover River, Wisconsin

Author: Rachael Valeria, *University of Wisconsin – Stevens Point*

Co-author(s): Logan Cutler

Abstract:

Coldwater streams are heavily dependent on critical elements derived from the surrounding forested riparian habitat. The vast majority of the stream's inhabitants, such as the economically and ecologically important Brook Trout (*Salvelinus fontinalis*), rely on macro-invertebrates that either fall into the water from the riparian zones, or are aquatic at some point in their life. A self-sustaining population of Brook Trout occupies central Wisconsin's Little Plover River, which has been historically strained through the effects of local agricultural land and ground water usage on the river's riparian areas. The focus of this study is to recognize the makeup of macro-invertebrates in the Little Plover River drift versus the diet composition of the river's Brook Trout population, among contrasting riparian areas. The three locations that were chosen on the Little Plover River corresponded with three different riparian habitats (forested, restoration, agriculture/grasslands). At all three locations in the fall of 2019, drift nets were deployed for 24 hours, and electrofishing was conducted immediately after. Brook Trout diets were obtained through gastric lavage and were in comparison with collected driftnet samples. In both the drift and the Brook Trout diets, the composition of macroinvertebrate communities were compared between each of the riparian habitat types.

Title: Black Crappie Influences on Walleye Natural Recruitment in Northern Wisconsin Lakes

Authors: Steven Broda, *Wisconsin Department of Natural Resources*

Co-author(s): Zachary Feiner, Greg Sass

Abstract:

Natural recruitment has declined in northern Wisconsin Walleye populations over time. Several factors have been implicated to explain Walleye natural recruitment declines including climate change, centrarchids, imbalances in fish communities, overexploitation, and cultivation/depensation effects. Anecdotal evidence has suggested that Walleye and Black Crappie may negatively interact, which may be a mechanism linking centrarchid abundance increases to Walleye natural recruitment declines. We used all available Wisconsin Department of Natural Resources total Black Crappie relative abundance and age-0 Walleye relative abundance data during 1991- 2017 to test for: 1) overall trends in age-0 Walleye and total Black Crappie relative abundance over time; 2) a relationship between age-0 Walleye and total Black Crappie relative abundance; and 3) patterns in age-0 Walleye and total Black Crappie relative abundances in a subset of lakes with longer-term data for both species over time. Overall, age-0 Walleye relative abundance decreased over time, whereas total Black Crappie relative abundance increased. The relationship between age-0 Walleye and total Black Crappie relative abundance showed a strong, threshold effect such that age-0 Walleye relative abundance was always low when total Black Crappie relative abundance was high. In a subset of lakes with longer-term data, most lakes showed reciprocal relationships between age-0 Walleye and total Black Crappie relative abundances. Our results suggest that Black Crappie may negatively influence Walleye natural recruitment; however, we caution that our findings only reveal pattern and not a mechanistic explanation for negative interactions between the species. A whole-lake centrarchid removal study is ongoing to test for mechanisms potentially leading to negative interactions among centrarchids and Walleye and additional research is critically needed to test for mechanistic interactions between Walleye and Black Crappie.

Title: Species-specific and Temporal Differences in Open Water versus Ice Angler Catch Rates in Wisconsin, 1990-2020

Author: Samuel LaMarche, *Wisconsin Department of Natural Resources*

Co-author(s): Zachary Feiner, Greg Sass

Abstract:

Information about species-specific angler catch rates during the open water versus the ice season are limited. We used all available Wisconsin Department of Natural Resources creel survey data during 1990-2020 to test for differences in Black Crappie (*Pomoxis nigromaculatus*), Bluegill (*Lepomis macrochirus*), Northern Pike (*Esox lucius*), Walleye (*Sander vitreus*), and Yellow Perch (*Perca flavescens*) angler catch rates between open water (May-October) and ice seasons (December-February) and to test for changes in angler catch rates over time for each season. Open water catch rates were significantly higher than ice season catch rates for Black Crappie, Northern Pike, and Walleye. In contrast, Yellow Perch catch rates were significantly higher during ice season, while no difference was found for Bluegill between seasons. Angler catch

rates significantly increased over time in Bluegill and Northern Pike during both seasons, while Black Crappie increased only during the ice season. Walleye and Yellow Perch showed no change in catch rates in either season. Our angler catch rate results align with observed increases in Bluegill and Black Crappie populations over time, challenge a general assumption that open water angler catch rates exceed ice angler catch rates in the case of Yellow Perch, and show that angler catch rates over time have either increased or remained stable possibly as a result of known hyperstability in walleye and panfish fisheries.

Title: Yellow Perch and water levels from Crystal and Sparkling Lakes, 1981-2019

Author: Diana Tapia, *University of Wisconsin – Madison*

Co-author(s): Logan Sikora, K. Martin Perales, Joseph Mrnak

Abstract:

Water level fluctuations have great influence on ecosystem processes. With climate change predicted to increase the frequency and intensity of precipitation events, a better understanding on the influence of water level on desirable game fish populations is warranted. To address this, we used a 39-yr dataset (NTL-LTER) to examine Yellow Perch (*Perca flavescens*) size in length over time related to varying water levels for Crystal and Sparkling lakes (Vilas Co., WI). Data for both lakes indicates a variable, yet a generally positive relationship between Yellow Perch mean length and water level. Though a time-lag is evident, we tend to observe greatest mean lengths in the years following peak water level (e.g., mean length from 2000 following water level from 1997). Using density dot plots, a relationship between relative abundance (i.e., denser grouping of dots) and water level was not evident over the time series. We attribute this covarying relationship to the rich history of aquatic invasions and subsequent whole-lake biomanipulations on Crystal and Sparkling lake (see discussion), likely confounding results. Nevertheless, the density plots provided a unique way to examine recruitment dynamics over time where year-classes are easily tracked. Crystal and Sparkling lakes are both pelagic-dominant systems. Minor increases in water level provides additional food and refuge for this species that exhibits multiple habitat preferences (i.e., littoral and pelagic). Rises in water level create unexploited resources and niche space, allowing for an increase in mean size. Identifying additional fish species impacted by water level changes, particularly negatively, may be useful for lake management. Further research into how abiotic factors (e.g., water level) influence desirable game fish is warranted given future climate predictions.

Title: Fecundity and Reproductive Potential of Black Bullhead (*Ameiurus melas*) in a North Temperate Lake

Author: Rebecca Henningsen, *University of Wisconsin – Madison*

Co-author(s): Logan Sikora, Joseph Mrnak

Abstract:

Information on Black Bullhead (BB; *Ameiurus melas*) fecundity and reproductive potential is lacking in current literature. However, BB can dominate the biomass in north temperate lakes,

alter water quality, and are known to negatively affect desirable fish species (e.g., Walleye *Sander vitreus*, Yellow Perch *Perca flavescens*). Thus, gaining a better understanding of Black Bullhead fecundity (eggs/female) and reproductive potential (total eggs) is critical. In order to assess fecundity, the ovaries of 59 sexually mature BB from Howell Lake, Forest Co, WI in 2020 were examined. These fish were removed from Howell Lake as part of a larger whole-ecosystem manipulation centered around BB removal. Each whole ovary was removed and weighed. Then a subsampled of the left ovary was removed, weighed, and photographed. Subsampled eggs were then enumerated, and total fecundity was estimated based on whole ovary weight. We paired fecundity estimates with length data to produce fecundity estimates based on Gabelhouse Length Categories (GLC). BB of stock size had a mean fecundity of 2,135 eggs/female; BB of quality size had a mean fecundity of 4,319; and BB of preferred size had a mean fecundity of 5,485. We then determined the proportion of the measured BB population (n=4,395) in each GLC. These proportions were multiplied by the total females removed estimate (n=11,180) to determine the reproductive potential 'circumvented' via our removal effort. BB removed from Howell Lake in 2020 had a cumulative reproductive potential of ~30 million eggs. Of this estimate, stock and quality sized BB contributed 61% and 36%, respectively. Information on size-based BB fecundity and reproductive potential may be useful to managers who are dealing with nuisance populations or are contemplating a BB removal.

Title: A roadmap for recovery: Developing methods used to cultivate and stock Lake Sturgeon (*Acipenser fulvescens*)

Author: Chelsea Rausch, *University of Wisconsin – LaCrosse*

Co-author(s): Orey Eckes, Doug Aloisi, David Schumann

Abstract:

Lake Sturgeon (*Acipenser fulvescens*) are considered at-risk of extinction in over 95% of their native range. An important tool in the restoration of this species has relied on the mass production of juveniles at federal and state hatcheries and using stream side rearing facilities in the Great Lakes region. Establishing standard methods to maximize survival and growth during the rearing process and increasing post stocking survival will support the continued preservation of this species. We compiled data from published literature and hatchery protocols to develop a roadmap for Lake Sturgeon cultivation using the best-available information. During the egg stage, survival to 14-days post hatch is maximized by deadhesion methods using commercially available Fuller's Earth to limit fungal growth. Applications of non-toxic disinfection (i.e., Iodophor) to reduce microorganism abundance also enhances survival and reduces parent to offspring disease transmission. An egg development temperature index created at Genoa NFH predicts progression of eggs and larvae through important life stages in varying water temperatures which helps managers prepare for critical survival events. Early preparation for each milestone greatly enhances the survival probability of sturgeon early life-stages. When juvenile status is achieved, a temperature growth index provides managers a predictive model to maximize growth and estimate feed consumption. Greater lengths of stocked sturgeon are positively correlated with survival of first year juveniles in the wild. Fish that were stocked > 20 cm had ~80% chance of surviving the first year after stocking. From egg development to stocking, these methods demonstrate successful techniques that achieve the end goal of

maximizing rearing and post stocking survival. This roadmap to success could lead this species down a road where the end destination is “recovered” by guiding future restoration efforts for at-risk Lake Sturgeon populations.