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Poster Presentation Abstracts

Growth of hatchery reared Chinook salmon in Lakes Michigan and Huron exhibits limited spatial variation but is temporally linked to alewife abundance

Presenting author: Allen Lane
Co-authors: Matthew S. Kornis, Darin G. Simpkins, David M. Warner, and Charles R. Bronte

Chinook Salmon Oncorhynchus tshawytscha were introduced into Lakes Michigan and Huron in the 1960s to diversify recreational fisheries and reduce overabundant, nonnative Alewife Alosa pseudoharengus. Alewife remain the primary prey of Chinook Salmon but have experienced substantial declines in abundance due to reduced food resources and salmonine predation pressure. The movements of Chinook Salmon have been linked to the density and spatial distribution of Alewife, but spatial patterns in Chinook Salmon growth have not been well documented and the temporal relationship between growth and Alewife density has not been evaluated during the current period of low Alewife abundance. We evaluated spatial and temporal variation in growth of Chinook Salmon in Lake Michigan and the U.S. waters of Lake Huron and explored linkages with Alewife density. Von Bertalanffy growth parameters were generally similar for recaptured coded-wire-tagged Chinook Salmon from different stocking locations and different recovery locations. Only a few small differences among stocking and recovery regions were evident, with regions divided into two subtly different groups with shared growth parameters. The small regional differences may be attributable to unique habitat and/or stocking characteristics of specific regions. In Lake Michigan average Chinook Salmon length at age also varied across years and was tightly coupled with annual lake wide densities of age-1 and older Alewife, suggesting that Chinook Salmon growth from 2012 to 2016 was constrained by Alewife density. Our findings are consistent with evidence of lake wide movements associated with foraging and support continued management of Chinook Salmon in Lake Michigan as a single population. Furthermore, similar growth in Chinook Salmon from Lakes Michigan and Huron corroborates evidence that Chinook Salmon move from U.S. waters of Lake Huron to Lake Michigan to feed and reinforces the recent decision to include most fish stocked in northwestern Lake Huron in the Lake Michigan population when managing for predator–prey balance.

Development and application of a standard weight equation for bowfin *Amia calva*

Presenting author: Chance Brown
Co-author: Joshua Raabe

Bowfin Amia calva are native, nongame predatory fish that have received limited management or research despite increasing recreational and commercial fisheries. This species lacks a standard weight equation (Ws), a tool that allows managers to evaluate the body condition or relative weight of an individual fish or by averaging the relative weights from a sampled population. Therefore, I developed a bowfin standard weight equation by soliciting length and weight data on 40 populations across the species range. I also sampled Bowfin in 2019 from two northwest Wisconsin lakes to evaluate estimated weights from the standard equation and their relative weights. Using metric units (weight in g, total length (TL) in mm), the developed standard weight equation is Ws= -5.0140 + 3.2436(log10 TL). The English unit equation (weight in pounds, TL in inches) is Ws= -7.6707 + 3.2436(log10 TL). Standard and relative weight estimates for Bowfin sampled in northwest Wisconsin in 2019 were anecdotally accurate, such as noticeably skinny males were estimated to be in poor body condition. By developing this Ws equation, bowfin health can be monitored in the future to aid in management decisions regarding the developing angling and commercial markets.

Light availability and biomass production in Swedish boreal lakes

Presenting author: Matthew Chotlos
Co-author: Holly Embke and Jake Vander Zanden

Water clarity can affect the productive capacity of fish populations by limiting light availability. One factor contributing to available light in lakes is dissolved organic carbon (DOC), which plays a major role in chemical, physical, and biological processes. Concentrations of DOC in northern lakes are increasing and the effects of these trends on fish communities are only beginning to be studied. Our research focused on sixteen boreal lakes in Sweden with varying concentrations of DOC. We calculated biomass production of European perch in each lake and related it to the light availability. Increases in DOC, and the resulting shifts in light availability, may drive a decline in fish biomass production with implications for wider trends in global fisheries.

Location and timing of spawning brook trout in the Little Plover River, WI

Presenting author: Natalie Coash
Co-author: Zach Mohr, Ben Schleppenbach, and Joshua Raabe

Brook Trout Salvenius fontanalis are a native salmonid species within Wisconsin that require cold, high quality, flowing water. Brook Trout naturally reproduce in the Little Plover River, a groundwater dominated stream in central Wisconsin, but experienced mortalities during low flows and dry reaches from 2005-2009 caused by drought and groundwater pumping. Recent efforts to improve watershed health and river flows include groundwater pumping changes, wetland restoration, and riparian and channel modifications. Understanding Brook Trout spawning locations (i.e., redds) and timing would aid in identifying important locations and time periods for restoration and protection. Therefore, we conducted weekly redd surveys in Autumn 2017-2019 by walking the main passage of the river and GPS marking observed redd locations consisting of at least two actively staging or spawning fish over a

designated redd. We mapped redds in GIS and compared locations to estimated groundwater inflow data. Brook Trout spawned throughout most of the stream but redd locations varied by week and annually. In 2017, redds were more dense in areas with higher groundwater inflows whereas in 2018/19 more redds were located upstream and at differing groundwater inflows. Varying redd locations could be due to differences in river flow, with much higher flows in 2018 and 2019 potentially influencing groundwater inflow or Brook Trout movement behaviors. Peak redd numbers occurred during the second and third weeks of November during all three years. This research provides valuable information on Brook Trout spawning behaviors and can be used to help ensure maximum benefits of restoration efforts and is part of an ongoing evaluation of the Brook Trout population and watershed restoration efforts of the Little Plover River.

Effects of hatch timing on piscivory and pre-winter length distribution of age-0 largemouth bass in Wisconsin lakes

Presenting author: Giancarlo Coppola
Co-author: Craig Kelling and Daniel Isermann

Largemouth bass abundance has increased in many lakes in the upper Midwest and these increases likely reflect trends in bass recruitment that are related to climate trends. Earlier hatching of largemouth bass should translate into longer growing seasons and age-0 bass would reach larger sizes earlier. Larger age-0 largemouth bass should result in greater occurrence of piscivory. Fish that transition to piscivory typically experience increased growth rates thereby increasing their probability of overwinter survival, which is a size-dependent process. Information on the early life history of largemouth bass in northern lakes is lacking and a better understanding of the mechanisms regulating bass recruitment is needed to determine how future climate trends may influence bass populations. Specifically, we collected age-0 largemouth bass from Wisconsin lakes in late summer (August-September) during 2012, 2013, and 2019 to determine the extent of piscivory occurring within these cohorts in relation to bass total length and hatch timing. This work represents one of the initial steps in determining how climatic conditions affect the early life history of largemouth bass and will allow us to simulate how climate-induced changes in hatch timing and first-year growth influence recruitment. Initial results demonstrate that the occurrence of piscivory varies among age-0 cohorts. Logistic regressions indicate that total length at which 50% of age-0 largemouth bass exhibit piscivory ranges from 58-77 mm. Length distributions suggest that the majority of age-0 largemouth bass in these cohorts have yet to grow to lengths where piscivory is likely to occur (mean total lengths < 58 mm). We will also present results regarding whether hatch timing is related to the extent of piscivory occurring within these age-0 cohorts.

Effects of commercial Fluridone herbicide on non-target fathead minnows Pimephales promelas

Presenting author: Angelo Cozzola
Co-author: Craig Kelling and Daniel Isermann

Fluridone is an aquatic herbicide popular for the selective control of invasive species such as Eurasian water milfoil (Myriophyllum spicatum) and Hydrilla (Hydrilla verticillata). The U.S. environmental protection agency (EPA) permits fluridone usage up to 150 ppb, though it is commonly applied to aquatic ecosystems at 3-30 ppb. In order for the active ingredient to be effective, fluridone concentrations must be

maintained for > 45 days. However, fluridone can be persistent in the environment with reported half-lives over 100 days, which can lead to prolonged exposure of non-target organisms. Previous experiments have investigated the effects of fluridone on non-target fish species using both technical grade and commercial formulations, but reported limited end points, tested concentrations above environmentally relevant levels, and chronic studies have used only technical grade active ingredient fluridone. Therefore, we explored the impacts of ecologically relevant concentrations of the commercial formulation SpritFlo (0.00, 3.00, 12.00, 20.00, and 100 ppb fluridone) on survival, growth, and reproductive endpoints on multiple life stages of fathead minnows (Pimephales promelas). We exposed adult fathead minnows, allowed them to spawn, and continuously exposed their offspring. Following 28-day adult exposure we will measure reproductive and sub-lethal parameters. Progeny of exposed adults will be continuously exposed in embryo assays where survival and malformations will be recorded daily, hatch rate will be recorded 5 days post fertilization (dpf), and behavioral assays will be measured 10 dpf. Our null hypothesis is that environmentally relevant concentrations of fluridone will have no impact on any of our experimental endpoints. This will be the first study to determine the impacts of chronic exposure of commercial fluridone on the non-target fathead minnow. Present findings will contribute to environmental risk assessment and decisions regarding the use of fluridone commercial herbicides to combat and control invasive aquatic species. This work is supported by the Wisconsin Department of Natural Resources.

Replicating northern pike cleithra ages using otoliths, pelvic fin rays, and scales: precision and sampling guidelines based on sex and total length

Presenting author: Dan Dembkowski
Co-author: Jim Miazga and Dan Isermann

We used cleithra, otoliths, pelvic fin rays, and scales from 458 Northern Pike Esox lucius collected from eight Wisconsin water bodies to determine if: 1) ages estimated using otoliths, pelvic fin rays, and scales provided similar age estimates to cleithra; and 2) between-reader precision and differences between lethal (i.e., cleithra and otoliths) and nonlethal (i.e., pelvic fin rays and scales) aging structures varied in relation to total length (TL) and sex. Age estimates ranged from 0 to 10 across both readers and all structures. Otolith-, pelvic fin ray-, and scale-based age estimates for both readers tended to be higher than cleithra age for Northern Pike with cleithra age ≤ 3 and lower than cleithra age for fish with cleithra age ≥ 4. Complete agreement rate between reader age assignments was 74% for cleithra, 70% for scales, 66% for otoliths, and 65% for pelvic fin rays; agreement rates within 1 year ranged 96-97%. Mean coefficients of variation (CVs) between readers ranged 7.0-9.3% and between-reader precision did not vary in relation to structure or sex. However, cleithra (mean CV = 7.5%) nominally provided the most precise age estimates for lethal structures and pelvic fin rays (mean CV = 7.0%) nominally provided the most precise age estimates for nonlethal structures. Pelvic fin rays were generally effective at replicating cleithra ages for Northern Pike ≤ 475 mm TL; above 475 mm TL, pelvic fin rays tended to underestimate cleithra ages. Our results provide useful guidance on structure selection for Northern Pike age estimation and suggest that the number of Northern Pike sacrificed for age estimation could be reduced by using pelvic fin rays to estimate ages of fish ≤ 475 mm TL, but that cleithra be used to estimate ages of Northern Pike > 475 mm TL.

Fishery contributions, seasonal movements, and spawning site fidelity of Green Bay walleyes

Presenting author: Dan Dembkowski
Co-author: Daniel Isermann, Todd Hayden, Christopher Vandergoot, Steven Hogler, Troy Zorn, and Charles Krueger

Green Bay supports one of the most prominent recreational fisheries for Walleyes in North America, as well as an important tribal subsistence fishery for Walleyes that occurs in Michigan waters designated by the Great Lakes Consent Decree for the 1836 Treaty of Washington. Joint management (by Wisconsin and Michigan Departments of Natural Resources) is complicated because fish spawn in many locations within Green Bay and its tributaries, but movements and fishery contributions of Walleyes spawning in these locations have not been evaluated. Consequently, we implanted acoustic transmitters into N = 339 adult Walleyes (≥ 457 mm TL) during fall 2017 and spring 2018 and will monitor movements during the next four years using an array of N = 192 stationary acoustic receivers positioned throughout Green Bay and its tributaries. Our approach will allow us to determine if Walleye populations in southern and northern Green Bay are supported primarily by Walleyes spawning near those locations or if there are substantial contributions from fish spawning in other areas of the bay, if stock contributions to different areas of Green Bay vary among seasons, and if Walleyes spawning within a region or specific tributary exhibit spawning site fidelity. Our approach will also allow us to determine if inferences regarding fishery contributions, seasonal movements, and spawning site fidelity from acoustic telemetry are consistent with those made from a conventional tag return study. Preliminary results suggest that the respective Walleye fisheries in southern and northern Green Bay are supported primarily by fish spawning in and around those locations with little mixing. Further analysis will provide better resolution to specific fishery contributions and greater insight to seasonal movements and the propensity of Walleyes to return to the same spawning location.

Conversations on utilizing the Bois Brule Lamprey Barrier as a fisheries management tool

Presenting author: Lydia Doerr

Of the eight species of salmonids that spawn in the Bois Brule River (Douglas County, WI) Steelhead, the migratory form of Rainbow Trout Oncorhynchus mykiss, is the most prized by anglers. This intense angler interest coupled with fluctuations in population over time creates the need to improve understanding of the mechanisms shaping the Bois Brule Steelhead population. For more than 30 years the salmonid migration has been monitored at the Lamprey barrier/fishway, producing an estimate of the number and species returning annually to spawn in the Bois Brule River. It is hoped that by coupling this long-term fish count with other data (i.e. environmental parameters, length-at-age, parr/smolt abundance, etc.) it will be possible to improve Steelhead management. This plethora of data could be combined in a myriad of ways, including but not limited to modeling the effect of environmental conditions on production and/or calculating the number of spawning adults required to fully seed the Bois Brule River. There is also the potential to modify the lamprey barrier to act as a weir providing the opportunity to tag returning adults and quantify out migrating smolts. It is hoped that conversations at this meeting will provide new ideas and facilitate unforeseen connections between variables. This project aims to combine data in a novel way to improve the understanding of the factors shaping the Bois Brule Steelhead population, in an effort to ensure perpetuation of this population for future generations of anglers.

Investigating the use of eDNA metabarcoding as a method for monitoring aquatic biodiversity in tributaries of Lake Michigan

Presenting author: Willie Dokai
Co-author: Kristen Gruenthal, Jessica Pruden, Katy Klymus, Bradly Potter, Dave Zanatta, Jennifer Wong, Carrie Tansy, and Wes Larson

Tributaries of Lake Michigan are important habitat for fish species of significant ecological and recreational value, as well as for unionid mussels, which are among the most endangered taxa in North America. Yet, distributional data for these types of species are often lacking or outdated. Previous research has demonstrated that eDNA metabarcoding efficiently and accurately detects the presence of a wide range of species in aquatic habitats without high-effort, gear-biased, or destructive sampling. We are developing an eDNA metabarcoding assay to assess the utility of this technique as a biological monitoring tool for unionid mussels in tributaries of Lake Michigan. The assay targets a 286 bp region of the mitochondrial cytochrome oxidase subunit I (COI) gene, and uses amplicon sequencing laboratory and bioinformatic workflows. We expect it will uncover sufficient interspecific variability to determine the presence of at least 16 different unionid species potentially extant in the sampled region. Concurrently, we will employ a previously developed eDNA assay that targets the mitochondrial 12S and 16S rRNA genes within the same samples to monitor the presence of fish species, providing us a more comprehensive understanding of the distributions of members of these two important aquatic taxonomic groups in Lake Michigan tributaries.

Assessing the effectiveness of an electrical barrier on controlling common carp movement in the Oconomowoc River

Presenting author: Zach Driscoll
Co-author: Ben Heusnner and Dan Isermann

Electrical barriers are effective tools used to control the movement of fish within aquatic systems. By blocking fish passage, these barriers can be used to keep undesirable species from entering and impacting areas beyond the barrier. For example, the Wisconsin Department of Natural Resources maintains an electrical barrier within the Oconomowoc River in Waukesha County. The goal of this barrier is to limit the upstream migration of common carp into Lac La Belle. Despite observations of common carp population declines within this system, questions remain over the effectiveness of this barrier as it was constructed in the 1980s and is considered old technology by today's standards. To evaluate the effectiveness of this barrier, in 2018 and 2019 common carp were implanted with acoustic transmitters. To track their movement, acoustic receivers were strategically placed upstream and downstream of the electrical barrier. In both 2018 and 2019, the barrier was turned off mid-summer to allow fish passage. While the electrical barrier was active, almost no fish was observed crossing the barrier. Conversely, as soon as the electrical barrier was turned off, the acoustic receivers clearly showed fish moving upstream and downstream of the barrier. This study suggests that the electrical barrier in the Oconomowoc River is effectively controlling migration of common carp within the system.

Reduction of Centrarchids results in increased yellow perch catch rate and size in a north temperate lake

Presenting author: Levi Feucht
Co-author: Holly Embke, Steve Carpenter, Daniel Isermann, and Jake Vander Zanden

Yellow perch (Perca flavescens) are an abundant, cool-water panfish throughout northern Wisconsin, commonly targeted by anglers and a key mid-trophic level fish in many lakes. Yellow perch are often under predation pressure and can struggle to establish a breeding area and find food given increased competition. In the case of one northern Wisconsin lake, McDermott Lake, yellow perch have become stunted and suffered a decline in population. In 2018 and 2019, ~200,000 Centrarchidae spp. were removed from McDermott Lake. Yellow perch catch per unit effort and size-at-catch across a variety of gears was monitored. In 2019, CPUE and size-at-catch of individuals collected in fyke nets increased most significantly, indicating potential compensation in response to reduced competition and/or predation from centrarchids. These changes may be attributed to the removal of the most abundant predator, Largemouth Bass, and the removal of many panfish which were competing with the yellow perch for resources. Through monitoring the response of McDermott Lake fishes to the environmental changes, we can further understand how yellow perch react and apply this towards the management of this cool-water species.

Design and development of an open-sourced, cost-effective water temperature sensor string

Presenting author: Kevin Gauthier
Co-author: Paul Schramm

Temperature is a “master variable” in aquatic environments, driving fundamental biotic and abiotic processes. Scientists and managers are increasingly interested in measuring water temperature at multiple depths at high temporal resolution, yet the environmental sensing technology required to do so is expensive. Here we describe our development of a temperature sensor string that accurately measures water temperature at 13 different depths every minute using open-source technology at a material cost of $220.

Trophic overlap among fishes resident to tributaries of Green Bay, Wisconsin

Presenting author: Jessie Hanson
Co-author: Mia McReynolds and Dr. Patrick Forsythe

Relationships between stream fish communities and available resources are dynamic, varying seasonally and between streams. Fishes’ diets can inform conclusions about a stream’s condition, habitat availability, and ecological function. We analyzed gut contents of fishes in two small tributaries to lower Green Bay, Lake Michigan. Baird Creek is perennial, and Wequiock Creek is intermittent; both drain catchments of roughly 50 km2 and are impacted by agriculture and suburban development. Gut contents were identified to order and enumerated for 168 individuals of 7 species, including the dominant species that occurred in each stream assemblage. We found that diet composition differed between stream assemblages (PERMANOVA, $p<0.0001$), driven by Wequiock Creek having a more diverse prey range for the fishes to consume. Creek chub (Semotilus atromaculatus) and white sucker (Catostomus commersonii) diets differed between streams (PERMANOVA, $p= 0.0088$) and between species, after accounting for stream ($p<0.0001$). These differences were due to Creek Chubs having a more diverse diet than White Suckers. Further analysis of internal parasites showed differences in parasite load between streams (median test, $p=0.034$), differences in mean abundance of parasite genera between Creek Chubs (Welch’s one-way ANOVA, $p<0.001$) and differences in the average count between parasite genera occurrence in all species (Welch’s one-way ANOVA, $p<0.001$). These differences are likely due to differences in abundance of secondary hosts (isopods and ostracods) between streams, which may lead to species and stream-specific variation in impacts to fitness. Interactions between food resources and parasite ecology affect fish

competition and success in small tributaries, though these functional questions are seldom investigated making this work unique.

Aquatic invasive species early detection and monitoring program

Presenting author: Cari-Ann Hayer

Aquatic invasive fish are problematic in both marine and freshwater systems, and invasions are occurring on a global scale. The Laurentian Great Lakes, the largest freshwater system in the world, have long been a case study for the potential negative consequences of aquatic invasive species on an ecosystem. Given the importance of the Great Lakes basin and its resources, it is imperative that further species introductions are detected early so management options can include future prevention or eradication. Monitoring occurs in the near-shore zone and tributaries of Lake Michigan at locations with high potential for reintroduction. The Green Bay Fish and Wildlife Conservation Office aquatic invasive species programs main goal is to optimally monitor juvenile and adult fishes utilizing numerous passive and active sampling gears to identify novel nonnative species, and make decisions to improve future detection efforts following an adaptive management framework. The assumption is novel nonnative species (at first introduction) exist in low abundance and at restricted geographic ranges prior to successful establishment and can be considered analogous to detecting a rare species.

Known age and growth of stocked northwestern Wisconsin muskellunge Esox masquinongy

Presenting author: John Hermus
Co-author: Jeremiah A. Gorne, Stephanie L. Shaw and Greg G. Sass

Accurate age estimation is an integral component of fisheries science and management. Recruitment, growth, and mortality are important factors influencing fish population dynamics, and consequently inform fisheries management. Estimates of these factors are influenced by, or rely on, an accurate understanding of age. Aging Muskellunge Esox masquinongy through the sacrifice of individual fish is socially unpalatable, and for this reason, known age and growth of Muskellunge is generally unknown. Our study collected Passive Integrated Transponder (PIT) tag data by tagging all extended growth Muskellunge fingerlings stocked into ten northwestern Wisconsin Lakes during 2009-2019, to then later recapture these fish to establish known age and growth. Our objective was to use known age, and the length upon recapture of each stocked Muskellunge, to determine L , K, and mean length at age using the Von Bertalanffy growth function. Our results confirmed sexually dimorphic growth similar to previous studies. Female L was longest at about 129 cm, while male L was shorter at about 101 cm. Female Muskellunge on average took nine or more years to reach 102cm, the state-wide minimum length limit for harvest. Minimal between lake analysis was conducted as more data is required for accurate lake-specific comparison. Our study provides an example for managers to collect lake-specific known age and population data for Muskellunge without sacrificing fish, while also validating current age and growth of northwestern Wisconsin stocked Muskellunge.

Diets of larval walleyes in northern Wisconsin lakes

Presenting author: Nathan Jaksha

Co-author: Dan Isermann and Dan Dembkowski

Walleye recruitment has declined in some northern Wisconsin lakes and previous research has indicated that a recruitment bottleneck is occurring at the larval stage in some of these lakes. Availability of prey utilized by larval walleye could affect early survival and subsequent recruitment. However, current information on diets of naturally-produced larval walleye in lakes of the upper Midwestern USA is lacking. Identifying important prey for larval walleye is the first step in determining whether availability of these prey may be a factor influencing recruitment. Consequently, we examined the diets of ≥ 100 larval walleye (typically ≤ 18 mm in length) collected from 13 northern Wisconsin lakes during 2016-2018. Larval yellow perch, Daphnia spp., and calanoid and cyclopoid copepods represented the majority of diet items we observed. Larval yellow perch were more prevalent in larval walleye diets than expected based on previous literature. Carapace lengths of zooplankton in larval walleye diets ranged from 0.27-1.8 mm for Daphnia spp., from 0.31-1.2 mm for calanoid copepods, and from 0.12-0.93 mm for cyclopoid copepods. Initial analyses suggest that availability of zooplankton within these size ranges did not differ between lakes showing declines in walleye recruitment when compared to lakes with sustained levels of recruitment.

Abiotic factors influencing brook trout abundance and recruitment within the Little Plover River, WI

Presenting author: Jason Lins
Co-author: Nathan Jaksha and Joshua Raabe

Brook Trout Salvelinus fontinalis are an important apex predator, sportfish, and biotic indicator of stream health that are threatened by changing climate, detrimental land and water use practices, and non-native species. To ensure proper management strategies of Brook Trout now and into the future, it is necessary to understand factors influencing population changes. The Little Plover River in Portage County, WI, is a second order groundwater fed stream inhabited by a self-sustaining Brook Trout population and no Brown Trout Salmo trutta. However, the stream has experienced extreme low flow periods, including dry reaches, due to extensive groundwater pumping and limited precipitation and may have changing water temperatures. Therefore, our objectives were to determine if annual Brook Trout abundance and recruitment varied in relation to precipitation, flow, or water temperature. Linear regression was used to evaluate potential relationships between Brook Trout relative abundance estimated from Wisconsin Department of Natural Resources barge electrofishing surveys between 1970-2014 and abiotic factors available for varying years. Brook Trout relative abundance ranged between 248-4300 with a mean of 1591. Precipitation displayed a strong positive relationship with Brook Trout relative abundance, adult abundance, and recruitment. Similarly, low flow periods correlated with lower relative abundance and smaller adult populations. Abundance did not appear to correlate with water temperature. Reduced abundance in years with lower precipitation and flows highlights the importance of maintaining groundwater input and water levels in sustaining Brook Trout in the Little Plover River and other streams.

Habitat use, thermal distribution, and diet of Brook Trout Salvelinus fontinalis as affected by interspecific competition with non-native Brown Trout Salmo trutta in the Driftless Region of southwest Wisconsin

Presenting author: Kristina Pechacek
Co-author: Eric Strauss, Kirk Olson, and Jordan Weeks

Brook Trout (Salvelinus fontinalis) and Brown Trout (Salmo trutta) are the two dominant salmonid species within the Driftless region of Wisconsin. Brook Trout and Brown Trout require cold, highly oxygenated water and are often found in stream headwaters. Brown Trout, a species introduced to the region in 1887, compete with Brook Trout due to similar habitat requirements. Brown Trout generally are the dominant competitor, but questions remain about how the two species interact in different habitats in the Driftless region. Therefore, the overall objective of the research project is to determine how interspecific competition affects Brook and Brown Trout thermal distribution, habitat use, and diet in two Wisconsin Driftless region streams. This study will examine a treatment stream (Maple Dale Creek) with Brown Trout removal and a reference stream (Cook Creek) with no fish removal. Data collection will occur in southwestern Wisconsin Driftless region during the summer of 2019 and 2020 using the Before and After Control Impact Design (BACI). We expect the removal of Brown Trout will reduce competitive pressure on Brook Trout, resulting in a shift in habitat use, diet, and thermal distribution. Significant shifts from interspecific competition within the food web will be measured using stable isotope analysis before and after the removal of Brown Trout. This research will provide predictive responses for future Brown Trout removal projects. Bringing light to adverse impacts of interspecific competition from Brown Trout on streams with similar characteristics in the Driftless region of southwest Wisconsin.

Environmental influences on Muskellunge Esox masquinongy and Walleye Sander vitreus angler catch, Escanaba Lake 2003 – 2015

Presenting author: Kathryn Renik
Co-author: Stephanie Shaw and Greg Sass

Angler experience and beliefs have suggested that environmental factors (e.g., season, lunar phase, wind direction) effect trip success and catch rates. Most studies, primarily marine-oriented, have focused on whether lunar cycles effect catch rates, with limited information on the effects of other potentially influential environmental factors. Our objective was to test for the influence of multiple environmental factors on angler trip success and catch rate of Muskellunge Esox masquinongy and Walleye Sander vitreus using information from the long-term compulsory creel dataset available at Escanaba Lake, Wisconsin during 2003-2015. Angler effort and catch data were grouped by angler party for annual ice off periods. Previous research found that angler effort, bait type (live or artificial), and guide status (guided or not) influenced the probability of trip success and catch rate of Walleye; these variables were also included in our study. Environmental factors investigated included barometric pressure change, change in water temperature, peak wind direction, average solar radiation, average air temperature, average wind speed, lunar illumination, and time fished (dawn, day, dusk). We used a hurdle model to test whether environmental factors influenced the probability of catching Muskellunge and Walleye (binomial zero hurdle) and total catch (negative binomial truncated positive count). Our preliminary results suggested that higher average wind speed, reduced average solar radiation, and fishing at dusk increased the probability of catching a Muskellunge, whereas lunar illumination and fishing at day or dusk influenced total catch. The probability of catching a Walleye increased with lower average air temperature, higher average wind speed, and fishing at dawn or dusk. Higher average wind speed, peak wind direction, lower average air temperature, and fishing at dusk influenced Walleye total catch. Further investigation may provide insight on angler behavior and information to improve an angler's fishing experience.

Habitat use, behavior, and condition of brook trout in a headwater stream in Wisconsin's central sands

Presenting author: Benjamin Schleppenbach
Co-author: Zachary Mohr and Joshua K. Raabe

Brook trout Salvelinus fontinalis are keystone predators and a popular sportfish in coldwater ecosystems in their native range of eastern North America. Sensitive brook trout populations are vulnerable to development and predicted increases in water temperatures in Wisconsin and elsewhere. Adaptive management strategies need detailed information of habitat use and other factors influencing self-sustaining populations within specific ecoregions. Passive integrated transponder (PIT) technology can advance knowledge of fish behavior and responses to ecological pressures, and identify locations for habitat protection, restoration and enhancement. Our objectives were to determine during 2016-2019 if habitat use, behaviors, and demographics varied among brook trout in different locations within the Little Plover River, a headwater stream in Wisconsin's Central Sands vulnerable to habitat degradation. We divided the river at the halfway point into downstream and upstream sections and using PIT antennas and physical captures evaluated movement patterns, body condition, survival and growth rates, and spawning locations. Of tagged brook trout, 84% stayed within either downstream or upstream habitat sections. Fish residing in the downstream section displayed larger size structure, higher growth rates for younger fish, and higher survival rates during the fall. There is evidence of exchange between downstream and upstream fish with 6% of individuals partaking in streamwide spawning migrations. Evidence of large numbers of fish residing, similar growth rates in fish <150mm and >200mm, similar survival rates during spring, summer, and winter, and majority of spawning locations found, indicate the upstream habitat section provides valuable habitat for brook trout. Continued habitat degradation within this section could potentially impact the longevity of the brook trout population in the Little Plover River.

Effectiveness of light based traps in the early detection and capture of bloody red shrimp Hemimysis anomala in Duluth-Superior Harbor

Presenting author: Jennifer Sherren
Co-author: Hannah Ramage

Harbor infrastructure and transoceanic shipping allowed for the introduction and establishment of the nonindigenous mysid, Hemimysis anomala, across the Great Lakes. H. anomala poses a risk to aquatic ecosystems as established populations in Europe have reduced algal and zooplankton biomass altering the patterns of energy flow to higher trophic levels. Lake Superior is the last of the Great Lakes to have established H. anomala. In 2018, USFWS found 13 individuals across 5 sites in the Duluth Harbor, leading to an established population status. There is a need for early detection and capture mechanisms to prevent further establishment of NIS into unaffected waters. The primary goal of this project was to detect H. anomala using light based traps to discern the presence of an established population. Secondarily, concurrent tows and traps from two sites were subsampled, sorted, and enumerated to assess trap effectiveness in capturing light attracted zooplankton when compared to vertical plankton tows. Light-based traps were deployed in areas with high boat traffic, directly adjacent to hardened shorelines. Samples were scanned for H. anomala, Bythotrephese longimanus, and Cercopagis pengoi, according to EPA standards. Traps were ineffective and did not detect Hemimysis, however they did attract Bythotrephese. Additionally, there were significant differences between the two gear types. Traps captured a significantly higher percentage of Bosmina spp., and the order Calanoida including nauplii (p-value < 0.05, paired two-sample t-test). Traps are a viable capture mechanism for the groups as they show

either an attraction to light or tow-net avoidance. Further work in light-trap design and deployment location may show greater catches of H. anomala in the Duluth-Superior Harbor. Finding an effective early detection and capture mechanism for H. anomala is essential to prevent further expansion of the current established population.

Early detection and monitoring for red swamp crayfish in Chicago

Presenting author: Bradley Smith
Co-author: Brandon Harris

Red Swamp Crayfish Procambarus clarkii are an invasive species of growing concern in the Great Lakes basin. The accidental or deliberate release of these organisms, especially in metropolitan areas, has resulted in numerous small populations that can spread to larger waters where they are difficult to manage or eradicate. Finding new invasive populations early is the best way to ensure managers have time to respond effectively. Here, we summarize ongoing collaborative efforts to survey and study Red Swamp Crayfish in the Chicago, Illinois area. We discuss broad-scale early detection surveys, discovery of a new population, and an occupancy-detection study. These efforts have provided valuable insights for monitoring Red Swamp Crayfish throughout the Great Lakes basin.

Reproduction ecology of northern pike: A case study within a restored Lower Green Bay wetland

Presenting author: Claire Stuart
Co-author: Rachel Van Dam and Patrick Forsythe

Northern pike (Esox lucius) are an apex predator and migratory fish endemic to the waters of Green Bay. In the early spring shortly after ice out, adults migrate up tributaries and agricultural ditches and broadcast spawn in seasonally flooded wetlands. Recent monitoring and research efforts have provided insight into the growth and recruitment dynamics of young-of-year northern pike. However, little information is available with respect to intra-annual variation in the timing of spawning activity, total stock size at the time of spawning, sex ratios during the breeding season and the age/size structure of breeding adults. Furthermore, we know very little about individual based behavior such as the duration between annual spawning events and spawning time based on sex/size. To address a portion of this uncertainty, adult northern pike were collected and tagged during spring migration using a weir-based system established at a single focal wetland with direct connection to Green Bay. In this study, we use 6 consecutive years of data (2014 – 2019), 1129 individual fish, and 124 total recaptured pike over 5 recapture events to examine variation in the timing of spawning, adult abundance, size structure, sex ratios and growth. We believe this information will prove to be valuable for the management of this recreational sportfish and conservation of the habitats that support their reproductive ecology.

Introduction to the FWS Native Species Program with highlights

Presenting author: Ted Treska

The FWS Native Species program in Green Bay focuses on native species restoration and monitoring fish communities to aid in management and restoration efforts around the lake. While early efforts mainly dealt with Lake Michigan proper, in recent years more and more attention has put into Green Bay, as it is inherently tied to the main lake, and is one of a few places where native whitefish are flourishing in the Great Lakes. While our efforts mainly benefit lake trout and lake whitefish, we have also contributed to monitoring overall forage estimates for the entire lake and are instrumental in an on-going restoration effort for bloater chubs in Lake Ontario. This submission will outline what we do and highlights from the work we have done and our intentions in the near future.