

rates, length limits did not measurably increase yield when natural mortality rates were greater than 30%. The greatest opportunities for yield improvement were observed for fast-growing black crappie populations under a 9-in MLL. Minimum length limits were predicted to improve size structure in slow- and average-growth simulations when conditional natural mortality rates were $\leq 30\%$; measurable improvements in size structure were observed for fast-growing black crappie populations when v was $\leq 40\%$. Our modeling suggests that understanding natural mortality rate is an important component in establishing effective harvest regulations for black crappie populations in Wisconsin, but estimates of fishing and natural mortality rates are lacking for most black crappie populations and these estimates are often difficult to obtain. Minimum length limits are most likely to be effective in black crappie populations with relatively low annual rates of natural mortality (i.e., $v < 30\%$); however, previous studies suggest that v generally exceeds 40% in most crappie populations. At high annual exploitation rates, minimum length limits should improve both yield and size structure unless too many fish are lost to natural mortality.

Lunch (provided)

Thanks for Coming!

-WIAFS & MIAFS

WIAFS/MIAFS Presentations

**February 7-9 2012
Marinette WI**

Wednesday 8:00 a.m.

Name: Ron Bruch

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Title: Use of a modified Form Factor to compare condition among North American lake sturgeon stocks

Co-Author: Kendall Kamke, WI DNR; Tim Haxton, Ontario MNR

Abstract: In fisheries management it is often useful to compare length and weight relationships or condition among populations across a species' range. Currently, the most commonly used metric for this is relative weight (W_r), although some problems have arisen with the use of W_r including the impact of seasonal changes in body condition due to reproduction, and length-related biases in standard weight equations. We propose the use of a modified form factor (mFF) based on the regression of $\log_{10}\alpha$ vs. β ; (weight-length model parameters) within a species, to provide a quick and meaningful comparison of mean condition among North American lake sturgeon populations. We used the α and β parameters from 63 lake sturgeon weight-length models from 43 lake sturgeon populations from throughout their range in the equation $mFF = 1000 \cdot (10^{(\log_{10}\alpha - (-2.129 \cdot (\beta - 3)))})$ to calculate the mFF for the 63 samples. Modified form factor values of juvenile, adult male, and female lake sturgeon from the Winnebago System, Wisconsin, in various stages of reproductive development had a 98.0% correlation with their respective relative condition values over a wide range of mFF values. Simple t-tests on sets of mFF values can be used to test the condition differences between populations or sub-samples within populations. Lake sturgeon from the Winnebago System, Wisconsin, USA were found to show W-L relationships best described in two stanzas: all juveniles < 71.1 cm, and juveniles and adults combined, but separate by sex, ≥ 71.1 cm. Likelihood ratio tests found significant differences between male and female (> 71 cm) W-L models; juvenile (≤ 71 cm) and male (> 71 cm) models; and juvenile (≤ 71 cm) and female (> 71 cm) models.

Name: John Lyons

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Title: Spawning ecology of shovelnose sturgeon and blue sucker in the Lower Wisconsin River

Abstract: Shovelnose sturgeon (*Scaphirhynchus platyrhynchus*) and blue sucker (*Cyprinus longatus*) are obligate large-river fishes for which many aspects of reproduction are poorly known. Since 2007, Wisconsin Department of Natural Resources biologists have been monitoring spawning of these two species in the 150-km-long Lower Wisconsin River (LWR) where blue sucker are protected and shovelnose sturgeon are thought to be only lightly exploited. Large numbers of both species spawn over a series of rocky shoals within a 5-km reach located 5-10 km downstream of the Prairie du Sac Dam. Blue sucker also spawn elsewhere in the LWR, but this is the only known spawning area for shovelnose sturgeon. Spawning for both species occurs for about a month from mid-to-late April through mid-to-late May. Spawning blue suckers average 636 mm (range 511-768 mm) total length with females having a greater mean size than males (675 vs 609 mm). Shovelnose sturgeon gender cannot be consistently determined externally; spawning fish average 645 mm (range 559-771 mm) fork length. Age determination from pectoral fin rays has been difficult and imprecise, but spawning fish of both species appear to range from 7 to at least 17 years old. Recaptures of PIT-tagged spawners indicate very little growth in length after up to three years at large, suggesting that upon reaching maturity, adults of both species direct most of their net energy intake into gonad production rather than somatic growth. Recaptures also suggest that at least some individuals of both species, including females, spawn in consecutive years.

Name: Alex C Wieten

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Title: Movement and Spatial Distribution of Lake Sturgeon in Muskegon Lake, Michigan

Co-Author: Matthew E. Altenritter, Carl R. Ruetz III, Kregg Smith

Abstract: Efforts to restore remnant populations of lake sturgeon are hindered by the lack of information on juvenile habitat

Title: Population- and individual-level effects of a microsporidian infection on mottled sculpins in Michigan streams

Co-Author: Carl R Ruetz III, Steven L Kohler

Abstract: Despite substantial amounts of information on diseases in fish, the influence of disease on natural populations of host species remains poorly understood. We examined the effects of a microsporidian infection (*Glugea* spp.) on mottled sculpins (*Cottus bairdii*) by sampling 30 individuals from each of 5 infected (>50% prevalence) and 7 uninfected populations (<5% prevalence). Infection status was determined by external and then internal visual observation of xenomas (hypertrophic host cells) within each fish's body cavity. Results were compared to quantify effectiveness of external visual diagnosis. Comparisons were made between infected and uninfected populations (mean fish age, mean length at age) and individuals (liver somatic index [LSI], stomach content mass, slope [b] of length-weight relationship). External examination detected the disease in 36.2% of infected fish. All incorrectly diagnosed infections were falsely identified as uninfected. Effects of infection on mean population age indicated a marginally significant result (mean age: infected = 1.68, uninfected = 1.90). Population length at age of infected fish was longer than uninfected among the oldest individuals. Infection did not significantly influence LSI; however, infected individuals had significantly less stomach contents than healthy fish and length was a significant covariate. Healthy individuals had similar b values regardless of sex (b = 3.04); however, infected females experienced positive allometric growth (b = 3.18), while infected males had slightly negative allometric growth (b = 2.95). Our results indicate that *Glugea* can significantly affect host mottled sculpin at population and individual levels.

Name: Kyle Mosel

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Title: Predictive Evaluation of Minimum Length Limits for Black Crappie Fisheries in Wisconsin

Co-Author: Dr. Daniel Isermann

Abstract: We determined if 9-, 10, and 11-inch minimum length limits (MLLs) are expected to improve yield and size structure in Wisconsin black crappie populations using slow, average, and fast growth trajectories estimated from Wisconsin DNR survey data. Length limit simulations were conducted across a range of annual exploitation (u) and natural mortality rates (v). Regardless of growth

monitor LWD placements by visual (watercraft and SCUBA) and biological evaluations to assess anchoring longevity and effectiveness. We believe this anchoring system may have application on other similar lake and stream habitat restoration/enhancement type projects.

Name: Kristin Thomas
Affiliation: Michigan Trout Unlimited
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Title: The Michigan Trout Unlimited River Stewards Program: using volunteers to monitor coldwater streams in Michigan.
Co-Author: Bryan Burroughs

Abstract: Michigan Trout Unlimited (MITU) volunteers have a strong desire to protect and enhance coldwater streams in Michigan. The River Stewards program was created to provide MITU chapters with the resources necessary to conduct stream monitoring. The program goals are to develop long-term data sets, prioritize restoration needs, and evaluate stream improvement and protection projects. Gathering baseline data (temperature, flow, habitat, fish, macroinvertebrates) allows protection and restoration needs within a watershed to be prioritized. Prioritization based on scientific data improves decision making processes. Post project monitoring to evaluate success is often not conducted due to limited funding and personnel. Volunteers can collect the before and after data needed to evaluate project success. The River Stewards Program began in 2009. During the first 3 years MITU volunteers have deployed over 50 temperature loggers in 7 watersheds, mapped in-stream habitat of over 15 miles of river in 4 watersheds, conducted fish surveys at 17 sites in 7 watershed, monitored aquatic macroinvertebrates at 20 sites in 4 watersheds, and conducted flow studies at 11 sites in 2 watersheds. Conducting stream monitoring of this nature provides meaningful volunteer opportunities to MITU members while providing important data. Professionals can use data collected to prioritize protection and enhancement projects and to evaluate the success of completed projects.

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requirements. We examined movements and spatial distribution of juvenile lake sturgeon in Muskegon Lake, Michigan, a drowned river mouth lake that links the Muskegon River to Lake Michigan. Juveniles were captured in gill nets, surgically implanted with ultrasonic transmitters, and tracked during August-November in 2008 and 2009 and from September 2010 to November 2011. Weekly vertical profiles of dissolved oxygen concentration and temperature were measured at two locations frequented by juvenile lake sturgeon (September 2010-November 2011). Juvenile lake sturgeon were observed near (≤ 1.0 km) the confluence of the Muskegon River in Muskegon Lake during summer months until early fall when a seasonal shift took place and juveniles moved to deeper waters, which coincided with fall overturn in the lake (i.e., loss of thermal and dissolved oxygen stratification). Additionally, multiple cohorts of juvenile lake sturgeon were caught in Muskegon Lake throughout the study. Our results suggest that Muskegon Lake serves as an important nursery habitat for juvenile lake sturgeon that hatched in the Muskegon River before they enter Lake Michigan and that there are seasonal shifts in the spatial distribution of juveniles in Muskegon Lake.

Name: Brenda M Pracheil
Affiliation: Center for Limnology University of Wisconsin
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Title: **Movements Of Shovelnose Sturgeon And Blue Sucker From The Mississippi River And Lower Wisconsin River Throughout Life History**

Co-Author: Peter B. McIntyre, John L. Lyons
Abstract: Shovelnose sturgeon (*Scaphirhynchus platyrhynchus*) and blue sucker (*Cyprinus longatus*) are obligate large-river fishes whose movements as they correspond to life history are poorly known. As part of a pre-mitigation assessment for a fish passageway at Prairie Du Sac Dam on the Lower Wisconsin River, we used otolith microchemistry to determine how shovelnose sturgeon and blue sucker-both of which spawn in the Lower Wisconsin River-use Mississippi and Lower Wisconsin river habitats throughout life history. Otolith microchemical analyses provide evidence that connectivity between the Wisconsin and Mississippi rivers is important for both focal species throughout their life histories. For example, while field collection data show the focal species spawn in the Lower Wisconsin River, our otolith microchemical analyses suggest that the Mississippi River provides critical early life history habitat. The apparent necessity of biotic connections between the

Wisconsin and Mississippi rivers for large river species underscores the importance of the fish passageway at Prairie Du Sac Dam.

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Name: Andrew J Repp
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Title: Determining Interaction Between Walleye and Black Bass in Northern Wisconsin Lakes

Co-Author: Michael J. Hansen

Abstract: Walleye and black bass are highly sought game fish species. Walleye are the most intensively stocked and harvested fish species in Wisconsin, while black bass are the most popular game fish species in the nation. Current angling regulations and stocking practices in Wisconsin often seek to simultaneously enhance populations of these species. Past studies have indicated that this may not be a feasible goal, because the species may interact negatively. I used data collected across many lakes in northern Wisconsin over many years to create indices of abundance, growth, population size structure, and recruitment rate. I used rank correlation and measurement-error model regression to test for relationships between these population demographics to determine if black bass and walleye populations interact. I attempted to determine whether a high abundance of one species is significantly related to any population demographic of the others. I found a negative relationship between black bass abundance and walleye abundance, a positive relationship between black bass abundance and walleye growth and size structure, and a negative relationship between black bass abundance and walleye recruitment rate. These findings are considered indicative of black bass preying on juvenile walleye. These findings suggest that stocking practices and angling regulations for both species may need to be changed to reflect the impossibility of enhancing populations of both species in one lake simultaneously.

allow managers to identify habitat restoration and barrier removal projects that will most benefit northern pike populations in Green Bay.

-----BREAK-----

Name: Doug Bradley
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Title: Dissolved oxygen acoustic telemetry tags: new tool, field testing and innovative applications wanted

Co-Author: John Wolfe, Penelope Moskus, Cory Suski, Greg Gaulke

Abstract: Advances in acoustic telemetry are greatly improving our ability to monitor fish responses to environmental stressors. Telemetry tools such as depth sensors, thermal and muscle-movement tags are allowing researchers to monitor the activity and response of free roaming fish to urban stressors. An acoustic, dissolved oxygen (DO) sensor tag from Denmark was recently tested in a pilot study on largemouth bass in the Chicago Area Waterways System, to better understand fish exposure during hypoxic and anoxic events. The tag tests allowed researchers to monitor real-time DO exposure in the field, compared to DO measurements from fixed sondes. This presentation will provide preliminary results of the Water Environment Research Foundation funded study, and will provide recommendations for use of the tags in future DO telemetry research.

Name: Steve DeVitt
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Co-Author: Al Niebur, Shawn Sullivan

Title: Fisheries Habitat Restoration on the Lower Wolf River - Large Woody Debris Anchoring System

Abstract: Increased riparian development and boating navigation have led to removal and loss of large woody debris (LWD) fish habitat in the Wolf River. The objective of our project was to cost effectively design reliable anchoring systems to secure whole trees to the river bed and to restore/enhance LWD in 5-10 sites in the lower Wolf River. Arrowhead earth anchors were used to secure whole trees to the riverbed. A total of 18 whole trees were secured using 15 anchors and 160 total man hours (crew of 4 in 40 hours). Anchoring system cost effectiveness was evaluated based on 2 project quotes from private contractors and showed that the project was completed at nearly a quarter of the contractor's quoted cost. We plan to

characterized each in terms of its fish community and nine physical reach-scale attributes. Gobies were detected in 47% of streams where their abundances ranged from 4% to 53% of fish sampled. Gobies were also the most abundant fish sampled, constituting 14% of all fish, and 30% of the fish in goby-present streams. Goby-present streams were generally larger with lower stream channel slopes, less large wood, and canopy cover than goby-absent streams, suggesting that these attributes may promote goby establishment. A principal components analysis was performed on the physical characteristics of the stream channel and three components were extracted and regressed against goby abundance. The principal component representing large wood and canopy cover was negatively related to goby abundance ($R^2=0.20$), while goby abundance was not related to other two. Analyses of fish community data revealed that goby-present streams had greater diversity and richness scores than goby-absent streams, and a lower abundance of sensitive species that are intolerant of habitat degradation. While these results demonstrate that round gobies are present in streams with varying physical habitats, they also suggest that goby abundance may be influenced by stream attributes and the structure of stream fish communities.

Name: Dan Oele

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Title: Modeling Spawning Habitat Suitability for Northern Pike in Tributaries of Green Bay

Co-Author: Matt Diebel, Tammie Paoli, Peter McIntyre, Evan Childress, Jeff Buckingham, Jeff Maxted, Andy Somor, Allison Shaw, Nicole Van Helden

Abstract: Recruitment of juvenile northern pike in Green Bay of Lake Michigan has been reduced by loss of spawning habitat, through both habitat degradation and barriers to access. Efforts are underway to increase recruitment by restoring wetland vegetation and hydrology and removing barriers to passage of adult pike, particularly at road crossings. Targeting these efforts requires an understanding of what constitutes good quality pike spawning habitat. We used field observations of adult northern pike spawning locations and juvenile outmigration, along with locations and estimated passability of migration barriers and GIS-based descriptors of land cover and hydrology, to model existing and potential spawning habitat suitability in the Duck-Pensaukee watershed of Green Bay. This model will

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Title: Population Trends and Management of Sauger in the Winnebago System

Co-Author: Robert P. Olynyk, Ronald M. Bruch, and Kendall. K. Kamke

Abstract: Sauger were the dominant sport fish in the Lake Winnebago System during the mid 1900s, however, due to a decrease in forage abundance, overharvest, and poor recruitment the population decreased in abundance during the 1980s. This decrease led to the implementation of an extensive management program to restore the sauger population. Management activities included the creation of spawning reefs on the north end of Lake Winnebago (historically the most extensive area of spawning activity), implementation of a voluntary catch and release program to limit harvest until more stringent harvest regulations were in place, and stocking of fry over a 10 year period spanning 2001-2010 (a yearly average of 799,840 OTC-marked fry were stocked off-shore per year, 14.4 fry/hectare). Results from fall bottom trawl surveys indicated that OTC-marked age-0 sauger comprised 0-82% of individual year classes, indicating that egg mortality, not fry survival was the major factor limiting recruitment. Catch rates of adult sauger also increased, and as of 2010, sauger are no longer protected against exploitation and fry stocking has ceased. Future trawling data will be used to evaluate the long-term success of the program and whether sauger can naturally reproduce to maintain a fishable stock.

Name: Tom Meronek

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Title: An evaluation of a walleye slot limit on the Wisconsin River

Abstract: A slot limit for walleye has been in place on the Wisconsin River since 2002, from the Prairie du Sac Dam (Sauk, Columbia counties) to the Grandfather Dam (Lincoln Co). A slot regulation was established from which walleye 15 to 20 inches could be harvested, walleye 20 to 28 inches could not be harvested, and only one walleye over 28" could be harvested. It was hypothesized that the slot would; 1) increase the river wide averages of PSD, RSD20, and RSD28, 2) increase the CPE for walleye 20-28" and those >28; and maintain CPE levels for walleye in the harvest slot (15-20"), 3) provide a regulation with no negative impact on growth rates of walleye. Here we present an evaluation of the effectiveness

of the slot over a period of 8 years using survey data from seven Wisconsin River Flowages.

We averaged pre-regulation and post-regulation walleye catch per unit effort (CPE) from comprehensive fyke net surveys conducted from 1995 to 2003 in the pre-reg period and 2005 to 2011 post-reg period. Results indicate for the lakes surveyed with fyke nets, stock density values were improved post-reg; average PSD increased from 24 to 46%, RSD20 from 8 to 19%, and RSD28 from 0.2 to 0.8%. Pre-regulation fyke net CPE for 10-15" fish was significantly greater than post-reg CPE ($p=0.036$), no differences were detected for 15 to 20" fish ($p=0.76$), there were significantly more fish 20" and greater ($p=0.001$). We have determined through our analysis that the objectives of the slot are being met and the rule has not had a negative impact on the Wisconsin River walleye fishery.

Name: Wayne Schaefer

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Title: Seasonal Production of a blue pigment, Sandercyanin, in the skin mucus of walleye in Canada

Co-Author: Mark Schmitz, University of Wisconsin - Sheboygan

Abstract: Blue pigment has recently been reported in the skin mucus of many walleye (*Sander vitreus*) populations in Ontario and Quebec, Canada. In 2007 we identified and named the blue pigment "Sandercyanin". The purpose of this paper is to report on the histological and seasonal production of Sandercyanin and to suggest a possible evolutionary function of the pigment. Microphotography shows that Sandercyanin is produced near blood vessels in the spines of dorsal and caudal fins. It is stored in cells located in the epidermis of the fish and in the skin mucus of the fish. Histological preparations, using PAS stain, show the novel cells producing Sandercyanin to be located just beneath mucus cells in the epidermis. We propose the name "pigment producing cells" (PPCs) for this new line of fish cells. Absorbance data for blue color in the mucus, accumulated over a period of five years, indicate that Sandercyanin is produced more abundantly in late summer than other times of the year. The fact that Sandercyanin is produced only on the dorsal side of the fish and is produced more abundantly in summer suggests a possible photo-protection function for the pigment. The fact that Sandercyanin is produced only in walleye in northern latitudes suggests a possible relationship to increased UV radiation caused by ozone depletion over the North Pole.

Name: Scott Hansen

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Title: Lake Whitefish in the Menominee River: Assessing a Re-Colonizing Population

Co-Author: Lakeshore Fisheries Team

Abstract: Historically, substantial numbers of lake whitefish (*Coregonus clupeaformis*) utilized the Menominee River for spawning. However, by 1870 they were extirpated in this area largely due to excessive logging activities. During the early 1990s, whitefish were increasingly being caught incidentally during WDNR surveys targeting other species in November, the whitefish spawning period. Over the following years, it appeared this population was becoming self sustaining as numbers grew. Within the last five years, the fall run of adult fish has become quite remarkable and these fish contribute to both the commercial and sport harvest in Green Bay. Beginning in 2009, the WDNR began conducting annual assessments of this fall run to help describe some general population dynamics. Boomshocking was the primary gear used to collect data including fish size, age distribution, post-spawn movement, genetic stock origin, and relative abundance. Genetic analysis indicates this population is likely a mixture of fish from multiple Lake Michigan stocks. Recoveries from whitefish tagged in 2010 reported to date suggest fish from this population do not migrate out of Green Bay. Age analysis confirms that this is a newly "found" population as there appear to be just a few age classes that are well represented. The limited number of years in the dataset and the large gap in time since whitefish populated the river make population abundance inferences tenuous. However, simply the presence of a viable population of whitefish once again in the Menominee is very encouraging.

Name: Tim Campbell

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Title: Factors governing the distribution, abundance, and community associations of the round goby in tributaries of Lake Huron

Co-Author: Scott Tiegs

Abstract: The invasive round goby is increasingly being reported in tributaries of the Great Lakes where these fish have been shown to impact native stream biota. Determining the characteristics and distribution of invaded streams are first steps toward effective management of their negative effects. We sampled 30 tributaries and

Thursday 8:20 a.m.

Name: Lucas Nathan

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Title: Temporal Stability of Lake Whitefish Stocks in Lake Michigan

Co-Author: Ryan Andvik, Brian Sloss, Justin VanDeHey, Randall Claramunt, and Scott Hansen

Abstract: Lake whitefish *Coregonus clupeaformis* are the dominant species of the Lake Michigan commercial fishing industry. This prominence has followed a dramatic population decline in the early 1900s. Contemporary research and management often prescribe the use of stock-based management to maximize the probability of sustainable populations and harvest. Previously, six genetic-based stocks were identified in Lake Michigan. However, the presence of genetic structure at any one moment represents a snapshot of spatial diversity that is vulnerable to the dynamic processes of variable migratory patterns, population sizes, and other demographic and lake-wide factors. Temporally-stable genetic units have a higher probability of containing genetically adaptive traits and, thus, are integral components of a sustainable stock-based management approach. The objective of this research was to determine if the previously delineated genetic structure of Lake Michigan whitefish stocks has been consistent over time. DNA was extracted from archived scale samples collected by state and tribal agency archives during the 1970s, 1980s, and 1990s. Samples were genotyped at 11 microsatellite loci and compared to contemporary stocks using a variety of tests. Most stocks showed temporal stability, however a few disagreements were observed with the stocks located in the Green Bay area. The prevalence of temporal stability within the genetic structure of Lake Michigan lake whitefish supports stock-based management of lake whitefish in Lake Michigan.

Name: Heath Benike

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Title: Response of Two Western Wisconsin Walleye Populations From Extended Growth Walleye Fingerling Stocking

Abstract: Lower Turtle Lake and Big Butternut Lake located in Barron and Polk Counties Wisconsin respectively had historic walleye populations that were sustained by natural reproduction. However, over the past 10-15 years natural reproduction of walleye on these two waters has stopped and efforts to improve walleye abundance and recruitment by stocking small fingerling walleye (< 2.0 in) were considered ineffective. The Wisconsin Department of Natural Resources conducted an experimental stocking program on each water by stocking extended growth (6-8) walleye fingerlings from 2004-2010.

The adult walleye population responded favorably to extended growth walleye fingerling stocking in each lake. The adult walleye population increased in Lower Turtle Lake from 1.1 fish/acre in 2004 to 5.3 fish/acre in 2011. Results were similar for Big Butternut Lake where the adult walleye population increased from 1.0 fish/acre in 2003 to 2.8 fish/acre in 2011. The increase in adult walleye abundance in both lakes during this time period is believed to be from extended growth walleye fingerling stocking efforts that have occurred over the above time period. The data collected also suggests that predation of some sort is likely limiting walleye recruitment at the fry and small fingerling stage in these two waters and that by stocking extended growth walleye fingerlings fisheries managers were able to avoid whatever recruitment bottleneck was present and increase adult abundance to desired management goals.

LUNCH

Wednesday 1:10 p.m.

Name: Ryan Koenigs

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Title: Effects of Electro-fishing on Walleye Adults and Gametes in the Winnebago System

Co-Author: Ronald M. Bruch, Kendall. K. Kamke, Frederick P. Binkowski, and Steven Yeo

Abstract: Walleye are the major game-fish species driving the recreational sport fishery on the Winnebago System, a fishery that annually contributes \$234 million to the local economy. Four public meetings were held during the summer of 2010 to obtain public input into an update of the Winnebago System walleye management plan. At one meeting, serious concerns about potential impacts that electro-fishing during spawning assessments had on walleye adults and gametes were expressed. To assess potential gear impact on adult survival, we used both fyke nets and electro-fishing to capture and Floy tag walleye during 2011 spawning assessments conducted on the Wolf River (5,459 male and 486 female walleye netted, 5,467 male and 465 female walleye electro-fished). To address the potential impact of electro-fishing on gametes, we collected and fertilized eggs from 12 walleye (6 netted and 6 electro-fished, all eggs were fertilized by males captured by respective gears), hatched the eggs, and raised the fry 22 days post hatch. We found no difference between mean tag returns rates of walleye captured with electro-fishing (5.9% for male and 2.8% for female walleye) vs. fyke netting (4.7% for male and 2.8% for female walleye). We also found neither egg viability nor growth of fry to be significantly different between fish sampled with the two gears. Electro-fishing does not appear to affect the survival of walleye adults and gametes on the Winnebago System, which is supported by the increase in densities and consistent strong year classes observed since annual electro-fishing sampling began in 1989.

Name: Mark Schmitz

Title: Ecomorphological divergence between walleye stocks in Lake Winnebago.

Co-Author - Tim Ehlinger UW-Milwaukee, Ron Bruch and Kendall Kampke WI-DNR

Abstract: The walleye population in Lake Winnebago, Wisconsin was used to explore ecomorphological differences among

Title: Accounting for Changing Patterns of Size-Specific Wounding of Lake Trout by Sea Lamprey in the Upper Great Lakes

Co-Author: Dr. James Bence, Ted Treska, Dr. Brian Irwin

Abstract: Parasitic sea lamprey (*Petromyzon marinus*) attack large-bodied hosts, such as lake trout (*Salvelinus namaycush*), and cause substantial mortality. These attacks leave wounds, or marks, on surviving lake trout hosts. Annual estimates of the marking rates on sampled lake trout are used to evaluate the success of a multi-million dollar sea lamprey control program and to provide information on sea-lamprey induced mortality used in lake trout assessment models. We estimated expected marking rates as a logistic function of lake trout size, assumed either a Poisson or negative binomial distribution for the expected number of wounds per fish of a given length, and fit models based on data collected in Michigan's waters of lakes Huron, Michigan and Superior. We used AIC to choose a best model for each lake. Candidate models allowed logistic function parameters to vary spatially, temporally, or both. Some of our model variants allowed for gradual changes in one or more of the logistic parameters based on random walk processes. Recent software advances for nonlinear models allowed us to treat random walk perturbations as random effects. Based on foraging theory we hypothesized that sea lamprey would gradually shift their feeding toward larger hosts when larger hosts were more abundant. We interpret temporal and spatial patterns in the inflection point of the logistic function (the size of lake trout at which the marking rates increase most rapidly) in light of this hypothesis. We also contrast the structure and estimates from our best models with those currently used in management.

4:15-5:30

Business Meetings

5:30-6:30

Buses to Peshtigo for Dinner

7:00-11:00

***Banquet in Peshtigo
(provided with registration)***

change was to improve the size structure of the brook trout population while increasing the opportunity for angler harvest. The protection of larger fish from harvest while increasing the harvest of fish less than nine inches was intended to increase the growth rate by reduction of intra-specific competition. The management objectives were to reduce the recruitment of 4-8 inch fish to 400-600 per mile and increase the abundance of greater than 9 inch fish to 120 per mile. Post regulation, the number of trout larger than nine inches has increased to 143 per mile, and the recruitment of four to six inch fish has declined from a high of 1351 per mile in 2007, to 347 per mile in 2011. The number of fish between 8 and 9 inches has increased from an average of 65 to 145 per mile. Likely predation by older protected individuals has reduced recruitment not angler harvest.

Name: Anna Varian
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Title: Status and Distribution of Lake Superior Brook Trout

Co-Author: Henry Quinlan, Mark Brouder

Abstract: Brook trout are the only stream dwelling trout native to the upper Midwest and populations have declined dramatically since early settlement of the region; however, the extent, severity, and in some cases, the specific cause of the decline is unknown. Current fishery data is being used to develop a GIS based model of the status, distribution and threats at catchment and subwatershed levels. Partner agencies have provided recent fisheries data collected throughout Michigan's Lake Superior basin. During 2011 we supplemented this data and sampled approximately 300 sites in Michigan's Lake Superior Basin. The data compiled will be used to classify all catchments and subwatersheds with current fishery data according to their brook trout population status.

Landscape metrics will be used to develop a classification tree model to predict brook trout status in areas where fishery data is insufficient. Georeferenced maps and data will be provided for fishery biologists, land managers, and other interested parties to evaluate and prioritize areas for protection, enhancement, or restoration of brook trout populations and cold-water aquatic habitat.

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walleye stocks that vary in the distance of upstream spawning migration. We employed geometric morphometric analysis of body shape to distinguish between stocks. Walleye were collected during spring spawning from both the Fox and Wolf Rivers. An electronarcosis unit was utilized to immobilize live fish to facilitate the collection of morphometric images. Additionally, adult walleye were collected from Lake Winnebago and Lake Butte des Morts during fall and implanted with sonic tags to allow us to test if whole-body shape could be used to predict where tagged individuals would spawn the following spring.

Morphological divergence was detected between male and female walleye and between stocks that migrate short (Fox River) or long (Wolf River) distances upstream to spawn. In both rivers, females have a significantly longer and deeper midsection compared to males. Furthermore, in comparison to the Fox River, Wolf River walleye possess a larger and deeper caudal peduncle; morphological adaptations that facilitate longer migrations to spawning grounds.

Assignment testing was employed to compare body shape of walleye implanted in fall to shape differences identified between Fox and Wolf River walleye. Analysis confirmed that morphological variation can be used to distinguish between these spawning stocks when they are intermixed and away from their natal rivers. This is significant as these techniques can be applied by fisheries personnel to determine the relative contribution of the Fox and Wolf River stocks to the overall walleye harvest.

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Title: Lake trout refuge effects on select fish species in the Apostle Islands region, Lake Superior

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Abstract: Aquatic protected areas (APAs) were established for various ecological and socio-cultural purposes in the Great Lakes, including facilitation of lake trout (*Salvelinus namaycush*) rehabilitation through creation of refuges protected from fishing mortality. To further investigate the ecological significance of two Lake Superior refuges on both target and non-target species, we analyzed fishery-independent survey data collected by the Wisconsin Department of Natural Resources since 1982 to compare trends in relative abundance of select fishes sampled inside versus outside these refuges. In addition to lake trout, the refuges' target species,

we evaluated trends in mean relative abundances of lake whitefish (*Coregonus clupeaformis*) and cisco (*Coregonus artedii*). We found that lake trout relative abundance was higher inside the refuges and also increased at a greater rate inside the refuges as compared to areas outside the refuges. Annual means in lake whitefish catch were higher in areas outside of the refuges; however, the rate of increase in relative abundance was greater inside refuge boundaries and was indicative of a refuge effect. Analysis of relative abundance of cisco, a prey item of lake trout, did not demonstrate significant trends in either refuge or non-refuge areas. Overall, this study highlights the potential importance of the refuges for enhancing fish populations beyond those that were the original target of the refuges, as demonstrated by the increasing relative abundance of lake whitefish in the refuges. Improved understanding of the role of Great Lakes APAs in fisheries management is therefore valuable for informing future decisions and guiding future research.

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Title: Thermal Tolerances of Fishes, a Literature Review
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Abstract: Recently, WI enacted new rules regarding thermal discharges. It can be expected that area fish managers will be asked for input during permitting or to review results of studies that have been submitted. The purpose of this paper is to provide useful guidance to these managers so that they can make informed decisions regarding possible impacts. I will describe how the method used to determine the upper thermal tolerance can affect the endpoint estimate by 5 C, on average. I will also discuss how acclimation temperature affects the resultant endpoint estimates, as well as the other factors that affect those estimates. I will also summarize the thermal tolerance values of various coldwater, coolwater, and warmwater species. This analysis revealed that the coolwater group is artificially derived and the thermal tolerances of its members overlap with many warmwater species.

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Name: Lee Meyers
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Title: Trophy Brook Trout- Fact or Fiction?

Abstract: Is a large brook trout fishery in Wisconsin possible, or will they remain a freak occurrence? I have been “chasing” large brook trout for 50 years. I will review brook trout angling and population changes over the years based upon my personal and professional experiences. I was fortunate to work in field that I grow up dreaming about, and given opportunities to study a resource that I pursued and idealized as a youngster. Twenty years ago, we published a study entitled “Seasonal Movement of Large Brown Trout in NE Wisconsin”. This study along with other papers at the time, lead to the idea of an open system (watershed) approach to stream and river management (high-lighted by many dam removals in WI). This paper summarizes large brown trout movements due to the fact the brook trout were not large enough to carry the radio tag technology available at the time. Brook trout (given Floy or PIT tags) were captured along with the browns and although the contacts were not as numerous as the radios, brooks appear to exhibit similar long range movements. Salmonids that exhibit these movements, often display excellent growth, likely due to better food resources. I propose a system approach for applying restrictive regulations with tight controls on mortality (Angling and Natural). Using the system approach together with a public participation (stakeholder) program will allow “effective” angling regulation implementation that will produce a trophy brook trout fishery in NE Wisconsin.

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Title: Evaluation of a 9 inch maximum length limit and response of brook trout population in Manley Cr, Sauk County WI

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Abstract: Intensive habitat enhancement work was completed on 7100 feet of Manley Creek Sauk County Wisconsin in 2002. Manley Creek has a naturally reproducing population of brook trout, *salvelinus fontinalis*. Brook trout recruitment increased dramatically from 2003-2008. During the same time period the abundance of brook trout greater than 9 inches declined every year. In 2009 a regulation change was implemented switching from a 3 fish daily bag limit with a 9 inch minimum length limit to a 5 fish daily bag limit with a 9 inch maximum length limit. The intent of the regulation