



**Wisconsin Chapter of the  
American Fisheries Society**

**Oral Presentation Abstracts**

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**Title:** The Status of Ciscoes in Wisconsin's Inland Lakes

**Co-Author:** John Lyons, Martin Jennings, Jeffrey Kampa, Greg Sass, Gretchen Hansen, and Andrew Rypel

**Abstract:** Ciscoes (*Coregonus artedii*) are an important prey species found in many of Wisconsin's deeper lakes containing pelagic habitats with cold, well oxygenated water. Impacts from climate change and anthropogenic activities on the landscape may both pose threats to ciscoes due the potential loss of oxythermal habitat. Loss of oxythermal habitat and subsequent decline of ciscoes could have implications for food webs and the quality of sports fisheries in Wisconsin's lakes. To address these concerns of decline, we sought to quantify changes in historical distribution of ciscoes and evaluate habitat conditions associated with cisco occurrence. Using historical fish distribution data, we assembled a list of 186 lakes containing valid cisco distribution records. We were able to sample 146 of the 186 lakes using multi-mesh vertical gillnets. Ciscoes were detected in 102 (69.9%) of 146 lakes sampled that had valid historical data; this reflects a 30.1% (44 lakes) decline in cisco distribution statewide. Generally, ciscoes occurred in lakes at higher latitudes, exhibiting greater maximum and mean depths, lower temperatures at dissolved oxygen concentrations of 3 mg/l (TDO3), lower trophic state index values, and greater stratification index values. Habitat conditions were more variable in lakes where ciscoes were not detected compared to lakes with ciscoes. Cisco distribution in Wisconsin appears to be largely dependent on lake bathymetry, latitude, and interacting measures of climatic variation and cultural eutrophication.

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**Title:** Cisco Population Characteristics in Wisconsin Lakes

**Co-Author:** John Lyons, Jeffrey Kampa, Martin Jennings, and Gregory Sass

**Abstract:** Cisco represent an important coolwater fish species in many northern Wisconsin lakes because of their roles as planktivores and as prey for economically-important sport fish such as walleyes and muskellunge. Cisco are sensitive to changes in oxy-thermal habitat and projected changes in climate and continued landscape-level perturbations will likely affect the demographics and dynamics of cisco populations in the future. However, little is known about the population characteristics of cisco because standard annual fishery surveys are not designed to sample these fish. Our objectives were to determine if growth and population demographics of cisco varied among Wisconsin lakes in relation to a suite of abiotic and biotic variables. Our analyses relied on cisco information obtained during vertical gill-net surveys conducted by WDNR personnel across the state of Wisconsin during the summers of 2013 and 2014.

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**Title:** Morphological Variation and the Influence of Habitat Conditions among Cisco Populations in Wisconsin Lakes

**Co-Author:** James Church, Timothy Parks, Daniel Isermann, John Lyons, and Martin Jennings

**Abstract:** Cisco (*Coregonus artedii*) are important prey for several economically-important sportfish species, particularly lake trout (*Salvelinus namaycush*), muskellunge (*Esox masquinongy*) and walleye (*Sander vitreus*). Unfortunately, cisco appear to be declining in parts of the Midwest. Wisconsin has 186 cisco lakes based on historical records, but little is known about the habitat conditions or the status of the cisco populations in most of these lakes. Several cisco morphotypes have been described throughout their range, which is important because variation in form is influenced in part by environmental conditions and may be an indicator of habitat suitability. We used standard geometric morphometric techniques to assess variation in cisco body shape observed among 17 lakes in Wisconsin. We used multivariate regression to relate shape variables against local environmental and land cover variables. Results of the morphometric analyses revealed two distinct morphotypes. Furthermore, we identified a significant relationship between body shape and water temperature at which dissolved oxygen reaches 3.0 mg/L in a vertical profile (TDO3). TDO3 was positively associated with the deeper-bodied morphotype ( $F_{2, 14} = 8.36, P = 0.004$ ), indicating the deeper-bodied morphotype is associated with poorer habitat quality for cisco. Sportfish population metrics could be influenced by the morphotype present in a lake. For instance, deeper-bodied cisco may become unavailable as prey to gape-limited predators more quickly than shallow-bodied cisco. Additional research examining the influence of environmental variables on cisco morphotype and the relationships between gamefish populations and cisco morphotypes could provide direction regarding environmental quality management and fish management in Wisconsin.

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**Title:** Relationships between Growth Trajectories of Walleye (*Sander vitreus*) and Cisco (*Coregonus artedii*) in Northern Wisconsin Lakes

**Co-Author:** Dr. Greg G. Sass and Dr. Daniel Isermann

**Abstract:** Understanding population dynamics between co-occurring fish species can be important for informing regional fisheries management policies. Despite being top predators, walleye (*Sander vitreus*) growth can be highly variable among lakes suggesting that a number of within-lake abiotic and biotic factors may be important. A recent statewide cisco (*Coregonus artedii*) assessment of inland Wisconsin Lakes was conducted to better understand the status of this important forage fish species at the southern extent of its range. In addition, an extensive, standardized walleye monitoring program has been conducted in the Ceded Territory of Wisconsin (CTWI) since 1990. We used data from both programs to compare walleye growth trajectories among lakes with and without cisco. Analysis of the growth characteristics of 87 populations of walleye across the CTWI revealed that female walleye reach greater asymptotic lengths in lakes with cisco than without, while male walleye asymptotic length did not differ among lakes. Walleye minimum length limits (15 and 18 inches) were reached earlier as a result of faster growth trajectories toward harvest length in lakes with cisco. In cisco-present lakes, yellow perch (*Perca flavescens*) mean length was significantly lower than lakes where ciscoes were absent. Analysis of cisco and yellow perch mean length showed a smooth transition of prey length versus lakes without cisco showing potential limits or truncations in prey lengths for larger walleye when maximizing the length of prey they consume. Significant variation in mean depth, maximum depth, and oxygen thermal parameters (TDO3) among lakes with and without cisco also suggest that lake characteristics are important drivers of cisco presence/absence.

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**Title:** Identifying Recruitment Bottlenecks for Age-0 Walleye in Northern Wisconsin Lakes

**Co-Author:** Dr. Daniel Isermann, Dr. Gretchen Hansen

**Abstract:** Understanding recruitment dynamics is important to managing exploited fish populations. Walleye (*Sander vitreus*) recruitment (measured as age-0 CPE in fall electrofishing) has declined in several northern Wisconsin lakes and the reasons for these declines are not known. The goal of our study was to identify potential recruitment bottlenecks for age-0 walleyes in two northern Wisconsin lakes where walleye recruitment has declined in recent years and compare these observations with two lakes where walleye recruitment has not declined. Our objectives were to determine if the following metrics differed between lakes with the two different recruitment histories: 1) population characteristics of adult walleyes; 2) spawn timing and relative egg density; 3) age-0 walleye CPE; 4) predation of larval walleye by panfish, 5) timing of age-0 walleye appearance in littoral zone; 6) diet composition of age-0 walleyes and 7) physical lake characteristics including temperature, conductivity, dissolved oxygen, and Secchi depth. I will summarize the first year of results from this project.

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**Title:** Spawning Habitat Availability and the Recruitment of Walleye in Northern Wisconsin Lakes

**Co-Author:** Brian Sloss, University of Wisconsin-Stevens Point, and Dan Isermann, U. S. Geological Survey, Wisconsin Cooperative Fishery Research Unit, University of Wisconsin-Stevens Point

**Abstract:** Efforts to assess the effects of walleye *Sander vitreus* habitat on walleye recruitment have been limited because habitat data is often lacking. The primary objective of our study was to determine if recruitment of walleyes in 16 northern Wisconsin lakes was related to spawning habitat characteristics. Mean water depths (m), proportions of suitable spawning habitat, proportional area with  $\geq 50\%$  egg deposition probability, and weighted mean embeddedness of coarse substrates were not significantly different between lakes with high and low walleye recruitment and there were no clear relationships apparent between habitat variables and age-0 walleye CPE. Our results suggest the mere presence of suitable and relatively abundant spawning habitat is not directly related to walleye recruitment level and that future research should focus on habitat variables associated with subsequent life history stages. Our findings were consistent with previous studies that showed the quantity and quality of available walleye spawning habitat was highest within 2 m of shore. The proximity of the most suitable walleye spawning habitat to shore highlights the importance of having statewide habitat protection plans designed to limit erosion and shoreline development. Furthermore, our results underscore the potential impacts of fluctuations in water levels that might render higher quality spawning habitat inaccessible.

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**Title:** New Information Regarding Identification of Young Brown and Black Bullheads

**Co-Author:** Carl Ruetz, Greg Chorak, Ryan Thum, and Jessica Wesolek

**Abstract:** Confident identification of black (*Ameiurus melas*) and brown (*A. nebulosus*) bullheads can be difficult for adults and seemingly impossible for juveniles. To identify fish using morphological traits, we counted gill rakers and compared determinations of pectoral spine serration prominence between two independent observers (to determine subjectivity). Observers independently agreed on 100% (n=67) of specimens <120 mm TL, and 72% (n=32) for fish  $\geq 120$  mm TL, which indicates pectoral spine prominence does become subjective in larger fish but there is a very clear difference in small fish. To confirm the morphological traits were definitive for species identification and address the possibility of hybridization, we performed two genetic analyses for each specimen based on DNA barcoding (mitochondrial DNA) and microsatellites (nuclear DNA). Results from DNA barcoding were unclear. Both hybridization and incomplete lineage sorting (i.e., groups have not genetically diverged sufficiently) could explain why we could not accurately separate brown and black bullheads using DNA barcoding. However, we found that with microsatellites 100% of the morphological identifications matched the genetic identifications with no signs of hybridization. Results based only on DNA barcoding can be problematic with brown and black bullheads due to their very recent divergence. Our findings support that pectoral spine serration prominence can be used with high confidence to distinguish between small (<120 mm TL) black and brown bullhead in the field, which eliminates the need to euthanize fish to count gill rakers in the lab.

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**Title:** Comprehensive Response to the New Zealand mudsnail discovery in Wisconsin

**Co-Author:** Maureen Ferry, Laura MacFarland, Chris Merkes, Keith Turnquist, David Rowe, Jeanne Scherer, Michael Sorge, Jodi Lepsch, Amanda Perdsock, and Tim Campbell

**Abstract:** The first discovery of New Zealand mudsnails (*Potamopyrgus antipodarum*) (NZMS) in the inland Upper Midwest was in benthic samples collected from Black Earth Creek, Dane County in 2011. Following the discovery, a comprehensive monitoring and prevention project was implemented, including winter benthic sampling and an environmental DNA (eDNA) pilot project. The results of the pilot project informed the design of a multistate eDNA surveillance effort where 45 sites in Iowa, Illinois, and Wisconsin were monitored for NZMS. The results provide a baseline understanding of NZMS distribution in the Midwest. Meanwhile, prevention efforts included partnering with the River Alliance of Wisconsin and Trout Unlimited to engage in wading angler outreach, constructing wader wash stations at known NZMS access points, and posting signs on other popular trout streams. This presentation will discuss monitoring and outreach efforts, their results, and future plans.

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**Title:** Monitoring Invasive Carp in the Upper Mississippi River

**Co-Author:** Trevor W Cyphers

**Abstract:** The lock and dam system on the Upper Mississippi River is thought to restrict fish movement at periods of low water or at certain dams. Our objective was to determine movement of the invasive bighead and silver carp in the Upper Mississippi River by using acoustic telemetry. Movement was monitored using 14 and 55 VEMCO VR2W receivers in 2013 and 2014 deployed from Pools 5A to 19. Nearly 1 million fish detections and 69 (80%) fish were detected post-tagging with passive and active tracking from Pool 16 to 19 during 2013-2014. More fish were observed moving downstream (19) than upstream (3). The remaining 44 fish stayed in their original pool. Bighead and bighead x silver carp hybrids comprised 100% of the telemetered fish moving upstream. Bighead carp also exhibited the most movement in and out of backwaters. This study is ongoing and will continue into 2016.

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**Title:** Bluegill predation on milfoil weevils

**Co-Author:** Ronald Crunkilton

**Abstract:** Eurasian watermilfoil, *Myriophyllum spicatum* L (EWM), is an invasive aquatic macrophyte. The aquatic milfoil weevil, *Euhrychiopsis lecontei*, is a native, specialist herbivore on milfoils that has been used as a biological control agent for EWM. Predation by sunfish (*Lepomis* spp.) can suppress weevil populations below the density necessary to control EWM. In a lake where weevil stocking has not led to an increase in weevil density, 3feet by 3feet exclusion cages stocked with weevils were manipulated to densities of Bluegill (*Lepomis macrochirus*) of 0, 2, and 4 per cage. Lake-wide density of weevils was determined by searching 3 stems of milfoil from 75 locations for all life stages of weevils. Weevil densities in the whole lake were between 0.01 and 0.03 weevils per stem (w/s). The average density of weevils in cages with no Bluegill was 0.31 w/s. Cages with 2 Bluegill averaged 0.02 w/s. Cages with 4 Bluegill averaged 0.01 w/s. An ANOVA determined that the difference in mean density values between treatments and the control was significant ( $P=0.0001$ ). These results indicate that Bluegill, even at relatively low densities, have a negative effect on weevil densities. Protecting stocked weevils in similar or larger cages may allow them to establish higher in-lake densities and control milfoil in some lakes. Further research should concentrate on determining the threshold at which sunfish become a limiting factor on weevils.

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**Title:** Carp removal as a cost effective tool in managing water quality.

**Co-Author:** Dr. Chin Wu, UW school of Engineering

**Abstract:** Removal of nuisance carp (*Cyprinus carpio*) from impacted surface waters represents a cost effective way to control phosphorous availability and improve water quality. Efforts in Dane county have focused on accurately quantifying carp populations and biomass. When these efforts are coupled with quantification of phosphorous load and its' re-suspension caused by carp, it becomes possible to "price" carp control in relation to other phosphorous control strategies now in use such as manure digestors, alum treatments or land purchase that facilitates safe land spreading of manure. In November 2013, we estimated a carp population of 90,000 individuals weighing 400,000 lbs represented 1050 lbs/acre of biomass in Cherokee lake, Dane county, Wi. Partner studies conducted by the University of Wisconsin school of Engineering showed carp capable of mobilizing \_\_\_ of P. Contract fishing removal of the Cherokee lake carp population could keep \_\_\_ of P from entering downstream Lake Mendota or save \_\_\_ in public funding currently used to manage P loads in the watershed.

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**Title:** Ashland FWCO Inaugural Year of Lake Sturgeon Streamside Rearing, Ontonagon River, Bergland Michigan, Yields Encouraging Results

**Abstract:** The Ashland FWCO is involved in a new project rearing lake sturgeon using a Streamside Rearing Trailer on the West Branch of the Ontonagon River, Bergland MI. This presentation will be a synopsis of our 2013 rearing season, and results of a tank density study we conducted.

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**Title:** Do Tag Weights Exceeding 2% of Total Body Weight Impair Lake Sturgeon Movement?

**Co-Author:** Ryan Koenigs, Ronald Bruch, Fredrick Binkowski

**Abstract:** A commonly practiced guideline for installing transmitters is that the transmitter weight should not exceed 2% of the fish's total weight in air. This guideline is believed to limit negative effects associated with tagging, but there is limited research to support this tag weight percentage. The objectives of this study were to compare the post-release dispersal rates of fingerling (265-305 mm total length) lake sturgeon *Acipenser fulvescens* surgically implanted with sonic transmitters equating to 2% and 4% of fish body weight and to compare dispersal rates between fish stocked in two river systems. Forty-eight hatchery reared large fingerling lake sturgeon were implanted with acoustic transmitters (weighing either 2% or 4% of the fish's total body weight) and then released into the Wolf and Fox Rivers, Wisconsin. Downstream dispersal rates of the 2% and 4% groups were not significantly different within the individual rivers, but were significantly different between rivers. Our study demonstrated that transmitter weight to body weight ratio can exceed 2% without noticeable effects on movement of fingerling lake sturgeon. We recommend that a 2% tag weight ratio be used as guidance, however, based on our results, the tag burden could comfortably be increased if longer transmitter battery life if required to accomplish study objectives.

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**Title:** Age and growth of Coregonous kiyi in Lake Superior

**Co-Author:** Derek H. Ogle; Mark R. Vinson

**Abstract:** Kiyi (*Coregonus kiyi*) are a Whitefish found only in Lake Superior. Kiyi primarily inhabit deep waters (>100m) of Lake Superior but little else is known about their biology and population dynamics. Our objective was to describe the age structure and growth of Kiyi to gain understanding and aid management of this rare species. We collected Kiyi from 7-9 sites in five regions throughout Lake Superior -- Western Arm, Isle Royale, East of the Keweenaw Peninsula, Northern Ontario, and Southern Ontario. Paired ages from scales and otoliths for 64 Kiyi showed agreement for otolith ages less than 8, but otolith ages were greater after age 8. Examination of an additional 228 otolith derived ages from two readers showed that between-reader agreement was high and precision had a low CV for otoliths. Consensus otolith ages were used to describe the age-structure and growth (von Bertalanffy growth function) among regions in Lake Superior. Population age structures were similar among regions, consisting of mostly age-5 through age-8 individuals. Kiyi growth appeared to be fast to age-4 (50% of asymptotic length reached by age-4), slow from age-4 to age-8, and very slow (few mm per year) thereafter.

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**Title:** The Effects of Experimental Lake Fertilization on Condition and Diet of Slimy Sculpin (*Cottus cognatus*) in Oligotrophic Arctic Lakes, North Slope, AK

**Co-Author:** Stephen Klobucar, Derek H. Ogle, and Phaedra Budy

**Abstract:** The Arctic is warming faster than any other region on the globe. These warmer temperatures, in combination with other climate change effects, may significantly increase nutrient inputs in lakes and thus affect lake biota. We examined how Slimy Sculpin (*Cottus cognatus*) populations responded following a long-term experimental lake fertilization (2001-2013). We collected ninety-four Slimy Sculpins in July of 2014 from one treatment (fertilized; Lake E5) and two reference (unfertilized; Lakes Fog 1 and Fog 2) lakes using a beach seine. We weighed and measured each fish, and removed and preserved each stomach. We classified stomach contents to the lowest taxonomic level possible. Sculpins in the fertilized lake weighed less on average than sculpins of similar lengths in both unfertilized lakes. Sculpin diets in all three lakes consisted of mainly larval chironomids (75%, 72%, and 53% of all observed prey items in Lakes E5, Fog 1, and Fog 2 respectively). Chydorus spp. was also an important prey item in all three lakes, but occurred more frequently in stomachs of fish in the unfertilized lakes (9% in E5, and 26% in Fog 1 and 45% in Fog 2). These results suggest that increased nutrient availability as a result of increased nutrient inputs might affect the condition of Slimy Sculpins, and the increased production could lead to a slight diet shift. A change in sculpin condition could in turn affect larger piscivores that are important subsistence fisheries in Alaska.

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**Title:** Fish Production and Ecotone Responses to Long-term Additions of Lake Coarse Woody Habitat

**Co-Author:** Andrew L. Rypel, Jonathan F. Hansen, Scott Toshner, and Thomas P. Rooney

**Abstract:** Fish behavioral responses (attraction and habitat use) are strongly correlated with the presence/absence of structurally complex habitats in lakes. Much less is known about fish community responses (e.g., abundance, reproduction, growth, production) to augmentations of structural habitat in lakes. In collaboration with Wright State University and in partnership with Dairymen's, Inc. of Boulder Junction, the Wisconsin Department of Natural Resources (WDNR) will begin a long-term, whole-lake study on Sanford Lake in 2015 to test for fish production responses to additions of wood in lakes. This project addresses one of the most critical research needs identified jointly by WDNR Fisheries Management and Science Services. The practice of adding wood to lakes to improve fish habitat ("Fish Sticks") is commonly used in Wisconsin fisheries management; however, the response of fish communities to this rehabilitation and enhancement tool have rarely been evaluated. In addition to measuring terrestrial and riparian ecosystem responses, the primary goal of this project is to test whether wood addition in the form of "tree drops" increases fish production, or the biomass of fish an individual lake can support. Fish production responses will be measured for popular sport fishes such as walleye, muskellunge, smallmouth bass, and yellow perch. Maintaining or increasing fish production may sustain fisheries through periods of ecosystem change and allow increased recreational fishing opportunities. Escanaba Lake of the Northern Highland Fisheries Research Area will serve as the reference system for this 25-30 year study. My presentation will outline the background, provide a description of the experimental design, and highlight the key fisheries management and ecological questions that will be addressed by this study.

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**Title:** Predicting walleye recruitment and survival to develop a decision tool for prioritizing management decisions

**Co-Author:** none

**Abstract:** Walleye recruitment, adult populations, and stocking success have declined throughout Wisconsin since the 1980's. The state of Wisconsin has invested millions of dollars in the Walleye Stocking Initiative to reverse declines in walleye populations. Stakeholders strongly prefer that stocking target lakes where re-establishment of natural reproduction is likely; however, the capacity to restore natural recruitment via stocking alone remains uncertain, and other management strategies may be more effective. At the same time, stocking can improve adult population densities when applied in locations most likely to experience high survival to adulthood. Our capacity to predict recruitment and stocking success is limited by lack of data on factors suspected to control walleye survival and recruitment, such as the availability of spawning habitat or critical prey species. Understanding how these factors affect walleye population size, survival, growth rates, and reproduction will allow managers to more effectively implement management and restoration strategies for walleye. In this presentation, I will discuss a proposed research project designed to identify characteristics of lakes associated with walleye early life survival of stocked and naturally reproduced fish. This research will enable actionable science to predict the likelihood of success of future management decisions and to develop a decision tool for managers considering alternative actions for enhancing and restoring walleye populations.

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**Title:** Comparison of Calcified Structures and Processing Methods Used to Estimate Largemouth Bass Ages

**Co-Author:** Daniel A. Isermann, Kaitlin Schnell

**Abstract:** Determining age structure and growth of fish populations is critical for effective management. In Wisconsin, most fisheries managers utilize scales for age estimation of largemouth bass *Micropterus salmoides*, but previous studies have shown that scale-based age estimates are not reliable, especially for older largemouth bass. While otoliths have been shown to provide accurate ages for largemouth bass, otolith removal requires fish sacrifice. Dorsal spines may offer another non-lethal alternative for estimating fish age, but spines have not been evaluated for estimating the age of largemouth bass. Furthermore, multiple techniques are used to prepare and view otoliths and spines for age estimation and few studies have determined if age estimates for individual fish are similar among methods. The objectives of this study were to determine if: 1) age estimates from whole otoliths were similar to estimates from sectioned otoliths for younger fish; 2) if whole and sectioned dorsal spines provided similar age estimates for largemouth bass; 3) if agreement with otolith ages is higher for dorsal spines than scales and 4) differences among spine, scale, and otolith ages are related to total length of largemouth bass.

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**Title:** Sea Lamprey Control and Assessment Efforts in Wisconsin Waters 2014-2015

**Co-Author:** NA

**Abstract:** The Sea Lamprey Control Program (Program) is charged with control of the Sea Lamprey (*Petromyzon marinus*), an exotic invader to the Great Lakes from the Atlantic Ocean, which due to its parasitic life stage can have severe impacts upon lentic fish populations. The binational, multi-faceted program is facilitated by the Great Lakes Fishery Commission and delivered by federal agencies in both the United States and Canada. These agencies work in cooperation with federal, state, and tribal partners, (including the Wisconsin Department of Natural Resources), to ensure Program success. Primary control of Sea Lampreys within the Great Lakes is achieved by applying lampricides in infested streams and lentic areas to eliminate larval Sea Lampreys before they metamorphose and parasitize economically important Great Lakes fish. Streams targeted for chemical control are selected based on assessments that estimate numbers of larval Sea Lampreys and identify their stream-specific distribution. In 2014, the State of Wisconsin legislature allocated funds to supplement Sea Lamprey control efforts in Wisconsin waters. Presented here are the results of the increased focus on Wisconsin streams in 2014 and indications as to where the additional effort will be placed in the upcoming year. Additional effort in 2014 included a consecutive treatment of the Nemadji River as well as investigation and assessment of 91 Wisconsin tributaries to Lake Michigan and Superior. These rivers have typically ranked as low priority for assessment of Sea Lamprey populations due to their intermittent or lack of historical sea lamprey infestation. During 2015, the Program plans to use funds for a consecutive treatment of the Peshtigo River as well as additional larval assessment activities on the Menominee, Fox and other rivers.

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**Title:** Tarr Creek Fish Barrier Removal

**Co-Author:** John Noble

**Abstract:** The Wisconsin DNR is cooperation with the Department of Army and U.S. Fish and Wildlife Service conducted a fish barrier removal and stream habitat restoration project on Tarr Creek and numerous tributary streams which are located on the Fort McCoy Military Base in Western Wisconsin. The primary purpose of this effort was to facilitate fish passage as well as provide access to critical headwater spawning and nursery habitat for native brook trout and other coldwater fish species. The presentation will highlight removal efforts and discuss future plans for additional barrier removal at the Fort McCoy Military Base.

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**Title:** Yellowstone Lake, Management thru Biomanipulation and Special Regulations

**Co-Author:** na

**Abstract:** Yellowstone Lake is a 455 acre impoundment located in northeast Lafayette County, Wisconsin created in 1954. The lake has undergone 2 drawdowns with chemical renovations in 1968 & 1983 to address undesirable fisheries dominated by carp, bullheads, and stunted black crappies. In 1998 the lake was scheduled for another drawdown and chemical renovation to address low numbers of desirable species and an abundance of carp, bullheads, and stunted black crappies. In place of the drawdown and chemical renovation, a management plan which included biomanipulation and special regulations was initiated. Our biomanipulation plan called for the removal of carp and bullheads with supplemental stocking of walleye, musky, and largemouth bass. Special regulations placed on the game fish populations (musky, walleye, largemouth bass, smallmouth bass, channel catfish and flathead catfish) included catch and release followed by harvest slot limits placed on walleye, largemouth bass, smallmouth bass, channel catfish and flathead catfish with an aggregate daily bag limit. Population trends were followed using fall night electrofishing surveys conducted annually from 1998 to 2014 and spring fyke netting in conjunction with spring night electrofishing surveys conducted on a 4 year rotation starting 2006. The prescribed management actions have resulted in a sustainable fishery with quality fish present.

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**Title:** Using side-scan sonar to assess habitat use of sub-adult lake sturgeon in the Wolf River, Wisconsin

**Co-Author:** Ryan Koenigs, Dr. Daniel Isermann, Dr. Ronald Bruch, Dr. Brian Sloss, Dr. Joshua Raabe

**Abstract:** Little is known regarding habitat use of sub-adult lake sturgeon in riverine portions of the Lake Winnebago system located in central Wisconsin. Understanding habitat use by sub-adult fish will improve lake sturgeon assessment by allowing biologists to better evaluate recruitment dynamics and identify critical habitat. Characterizing habitat and substrate in aquatic environments using traditional transect-based methods can be difficult, time consuming, and expensive. However, the availability of small, portable, and inexpensive side-scan sonar devices now offers a more efficient means of mapping physical habitat in aquatic systems. Our objective is to determine if sub-adult lake sturgeon selectively occupy certain habitats in the lower Wolf River based on substrate, depth, and presence of coarse woody debris. Habitat availability in the lower Wolf River was mapped using side-scan sonar. Eighteen sub-adult lake sturgeon (26-50 inches) were implanted with radio transmitters in fall of 2013 (n=12) and 2014 (n=6). These fish were located approximately every 2 weeks and habitat variables were recorded at each location. Small sub-adult lake sturgeon (26-34 inches) tended to have much smaller home ranges than large sub-adults (34-50 inches). Also, all sub-adult lake sturgeon tend to be located over fine substrate and in deeper sections of river when compared to river depth in surrounding sections.

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**Title:** A Spatial Capture – Recapture Model to Estimate Fish Survival and Location from Linear Continuous Monitoring Arrays

**Co-Author:** Beth Gardner, Joseph Hightower

**Abstract:** Advances in telemetry technology, including smaller transmitters and stationary receivers, allow studies to collect a plethora of spatial data on tagged individuals. While computing capabilities and software (e.g., GIS) offer options to analyze spatial data, quantitative models capable of using all data points are lacking. We developed a spatial capture-recapture model to evaluate survival, location (i.e., activity centers), and movement of migratory fishes from linear telemetry arrays and present an American shad *Alosa sapidissima* example from a North Carolina river. Using a resistance board weir near the river mouth, we tagged individuals with passive integrated transponders (PIT) in the spring of 2010. An array of upstream PIT antennas passively recaptured individuals during upstream and downstream movements. The river channel constrained movements, resulting in linear and one-dimensional data. Using a Bayesian framework in JAGS software, our spatially explicit version of the Cormack-Jolly-Seber model incorporated all antenna recaptures and accounted for movement patterns across time periods for each individual. We found American shad had low spawning survival (i.e., 0.80 weekly survival) and moved more extensively during high flow periods. This spatial capture-recapture model is applicable for any linear array (e.g., rivers, lake shorelines, coastal routes), opening new opportunities to study demographic parameters and patterns in movement or migration and habitat use.

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**Title:** Volunteer River Guides as a Source of Fisheries Data Collection

**Co-Author:** David Neuswanger

**Abstract:** Large warm water rivers present many challenges to management agencies interested in gathering reliable fisheries data on sportfish. Access, gear limitations, funding, and timing all contribute to sampling difficulties and inefficiencies. In response, the Hayward Fish Team of the WDNR enrolled local private fly fishing guides in a detailed angler diary project to enhance understanding of large river fish populations, particularly smallmouth bass and muskellunge. This project has been in effect for three fishing seasons totaling over 800 completed angler trips on the Namekagon, Chippewa, and Flambeau rivers. Data generated from this project has enhanced our understanding of size structure and abundance of smallmouth and muskellunge within and among rivers. This project has also lead to insights into water level management of rivers and associated impacts on fishing quality. While there are several challenges in initiating and maintaining these types of angler/agency partnerships, they can be an efficient means to collect relevant fisheries data.

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**Title:** “Fillet ‘em and weigh ‘em”: using panfish fillet weights to explore angling regulation options

**Co-Author:** Andrew Rypel, Jon Hansen, David Rowe

**Abstract:** “Panfish” are often managed to provide consumptive opportunities for anglers. Thus, a potentially useful common currency for evaluating panfish management outcomes is total fillet yield. We acquired fillet weights from a total of 560 panfish (white bass (*Morone chrysops*), pumpkinseed (*Lepomis gibbosus*), bluegill (*L. macrochirus*), pumpkinseed-bluegill hybrids, black crappie (*Pomoxis nigromaculatus*), and yellow perch (*Perca flavescens*)) filleted by 25 current or former WDNR staff from 22 populations on 32 dates. Our objective was to describe the relations between fillet weight and both body weight and total length as a tool for evaluating trade-offs in fillet yields under different panfish size- and bag-limit fishing regulations. On average, fillet weight (skin off, no ribs) as a proportion of body weight was 33% for white bass and yellow perch, 32% for pumpkinseed-bluegill hybrids, 30% for pumpkinseed and bluegill, and 28% for black crappie, although only yellow perch and bluegill were significantly different from each other. Within species there were significant differences in this proportion among water bodies and among filleters but not among seasons or between sexes. For bluegills, this proportion increased with total length from about 27% for a four-inch fish to 33% for a ten-inch fish, but for the other taxa the proportion remained constant with length. Based on equations relating fillet weight to total length, one pound of fillets could be obtained from 25 six-inch, 9 eight-inch, or 4 ten-inch bluegills, whereas for black crappie 12 eight-inch, 6 ten-inch, or 3-4 twelve-inch fish could produce a pound of fillets, and for yellow perch a pound of fillets could result from 37 six-inch, 15 eight-inch, 7 ten-inch, or 4 twelve-inch fish.

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**Title:** Clark Creek Restoration and Stabilization

**Co-Author:** Steve Gaffield, Marty Melchior, Ben Lee

**Abstract:** Clark Creek is a small stream in Sauk County that originates on Devils Lake State Park (DLSP) which descends through a narrow valley to the Baraboo River. Clark Creek has a low density but naturally reproducing brook trout population. Since the Late 1990's Clark Creek has had a series of flooding events that have caused infrastructure and environmental damage. Following the massive flooding in 2008, Sauk County applied for and was granted a Community Development Block Grant from the Wisconsin Department of Commerce to aid the County in assessing and implementing flood damage control measures. The impact of reduced flood discharge on the water surface elevation, channel velocity and shear, and flooded valley width was evaluated using a HEC-RAS hydraulic model. Six areas of active erosion were surveyed and a strategy of relocating the stream away from the valley wall and stabilizing the channel with large wooden engineered revetments was agreed to with DNR Parks, and Sauk County. In October of 2013, on DLSP property 160 acres of cropland was converted to native prairie and 22 acres were converted to wetland. The wetland scrapes and native prairie vegetation have increased potential to reduce peak flood discharge. In combination, they could create reductions of approximately 40% for smaller floods and 10 - 20% for the 100-year and larger events. The stream bank and valley wall stabilization was also completed in October 2013 and three eroding bluffs on DLSP property were stabilized while realigning the creek and improving the habitat for the native brook trout that occur in Clark Creek. This presentation will discuss the role of Fisheries Management in addressing the flooding and stream degradation while working cooperatively with many external partners to mitigate the flooding and stream bank erosion issues while maintaining the environmental and aesthetic qualities of Devils Lake State Park.

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**Title:** Growth, Condition, and Short-term Survival of Age-0 Muskellunge Reared Using Two Different Techniques

**Co-Author:** Justin A. VanDeHey, Brian L. Sloss, Tim D. Simonson, Richard A. Klett

**Abstract:** Muskellunge *Esox masquinongy* are commonly reared on natural prey in hatcheries. However, this method is expensive and introduces biosecurity risks. Formulated feeds (pellets) are now being used by some agencies, however concerns exist regarding the size and post-stocking survival of pellet-reared Muskellunge compared to those reared on natural prey. Our objectives were to (1) determine if growth and condition differed between pre-stocking age-0 Muskellunge reared solely on natural prey (minnow only; MO) with those reared intensively on pellets and finished extensively on minnows (minnow finished; MF) and (2) determine relative survival of stocked Muskellunge reared using the two different techniques. During 2013 and 2014, fingerling Muskellunge (N≈6,000/treatment/year) were reared, marked, and stocked into 23 lakes throughout Wisconsin. Average condition was higher for MO fish (K= 0.581; 0.587) compared to MF fish (K= 0.532; 0.495), during 2013 and 2014 respectively. Minnow only fish were significantly larger (both length and weight) at stocking than MF fish both years (P<0.001 in all tests). Nighttime boat electrofishing catch rates were used to assess short-term (2-6 weeks) post-stocking survival. Capture rates were higher for MO fish (10.0%; 7.1%) compared to MF fish (7.3%; 4.4%) during 2013 and 2014 respectively, however, a large number of fish were captured from both treatments. This could suggest that survival was higher for MO fish. However, formulated feeds may be a viable method if the cost to rear more individuals, to offset reduced survival, is less than the cost to rear fish on natural prey and hatcheries have available rearing space.

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**Title:** Predicting abundance of adult muskellunge in northern Wisconsin lakes

**Co-Author:** Daniel Isermann, Timothy Simonson, Joseph Hennessy, and Thomas Cichosz

**Abstract:** Most Wisconsin muskellunge *Esox masquinongy* populations occur within the Ceded Territory of northern Wisconsin, where mixed fisheries consisting of a recreational hook-and-line fishery and a tribal spearing fishery occur. Safe harvest levels for each population are based on estimates of adult muskellunge abundance. Estimates of adult muskellunge abundance used to establish safe harvest levels are obtained from mark-recapture surveys that are conducted on a few lakes over a two year interval. These estimates are considered valid estimates of abundance for up to two years after the initial marking of fish. If a recent population estimate is not available for an individual lake, a linear regression model is used to predict adult abundance from lake surface area using existing population estimates from all lakes. A similar approach is used to predict abundance of walleyes, but the amount of variation in adult abundance that is explained by lake surface area is much higher for walleyes than for muskellunge. Therefore, the objective of our study is to determine if alternative models can be used to explain greater variation in the abundance of adult muskellunge within northern Wisconsin lakes than the current linear model that relies solely on lake surface area as a predictor variable.

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**Title:** Smallmouth bass population characteristics in the Menominee River, Wisconsin-Michigan

**Co-Author:** Daniel A. Isermann

**Abstract:** Several segments of the Menominee River that borders the states of Wisconsin and Michigan support exceptional fisheries for smallmouth bass. Fishery managers would like to know more about the abundance, growth, and mortality of these populations in order to make more informed management decisions. Our primary objectives were to describe the population characteristics of smallmouth bass in a portion of the Menominee River below Grand Rapids Dam to determine if current harvest regulations are sufficient to maintain the quality of this fishery. During 2014, smallmouth bass were collected by electrofishing and angling were tagged with numbered t-bar anchor tags and a dorsal spine was removed for age estimation. The Wisconsin Smallmouth Alliance offered rewards to encourage anglers to provide location and harvest information on tagged smallmouth bass they encountered. We also used angler diaries to gain information about the smallmouth bass fishery. Population information was used in age-structured population models to evaluate the effectiveness of different harvest regulations in maintaining high size structure. We will discuss the results of this work.

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**Title:** Riverine food-web structure varies longitudinally with natural and anthropogenic influences

**Co-Author:** Dr. Allison Pease

**Abstract:** Understanding how aquatic communities change with natural variation along longitudinal gradients, and how they respond to anthropogenic impacts, is critical for effective riverine management. In addition to natural shifts along its continuum, the Pecos River is impacted by a variety of anthropogenic influences that affect water availability, salinity, and riparian and instream habitat structure. We assessed variation in main-stem river food webs by estimating carbon sources, trophic positions, niche breadth, and resource use by consumers at twelve sites with stable isotope analysis. We found that across physiographic regions, fish species richness, food chain length, and assemblage-wide niche breadth were inversely related to specific conductivity. IsoError mixing models revealed differences in sources of dietary carbon supporting fish production along the longitudinal fluvial gradient, with a shift toward reliance on algal production in the Permian Basin region. Trophic niche breadth was greatest for assemblages in less degraded sites with higher fish species richness. Our analyses also suggest that anthropogenic inputs may be enriching baseline nitrogen isotope ratios at one Permian Basin site. Across seasons, isotope signatures remained fairly constant in five common fish species. Characterizing changes in food-web structure in relation to natural and anthropogenic factors is important for habitat assessment, stream restoration, and management and conservation strategies.

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**Title:** The Development and Validation of Environmental DNA as a Surveillance Tool for New Zealand Mudsnails in Trout Streams of Wisconsin

**Co-Author:** Keith Turnquist, David C Rowe, Maureen M Ferry, Christopher B Rees, Jon J Amberg

**Abstract:** New Zealand mudsnails (*Potamopyrgus antipodarum*) (NZMS) were identified in benthic macroinvertebrate kick net samples collected from Black Earth Creek (Dane County, Wisconsin) in 2011 and 2012. This was the first known discovery of NZMS in the Midwest outside of the Great Lakes basin and represents a possible threat to state and regional water resources. Following the discovery, additional benthic samples were collected from Black Earth Creek and other popular trout streams throughout Wisconsin. No infestations were identified in other streams. However, the snails (which can be as small as a grain of sand) are difficult to find at low population densities, and sorting kick net samples is lengthy and labor intensive. As a result, a pilot study was completed using water samples from four tributaries and ten sites on Black Earth Creek to determine if environmental DNA (eDNA) sampling could be used as a more efficient method for identifying the presence of NZMS. After successful eDNA detection of NZMS populations at the original discovery site and at another infested site in Black Earth Creek, new eDNA markers were tested in a multiple-lab, blinded validation study. Results indicated that the new eDNA markers were successful in detecting NZMS DNA in all known-positive samples with sequence confirmation and did not result in any false-positive detections. This validated eDNA assay will be used for future eDNA monitoring of the NZMS invasion.

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**Title:** Using Environmental DNA to Detect Endangered Redside Dace,  
*Clinostomus elongatus*

**Co-Author:** Scott Reid, Chris Wilson

**Abstract:** Effective management of endangered species requires sensitive detection of their occurrences, which is often difficult for low-abundance species. In aquatic environments, detection of rare species can be further confounded by site accessibility, sampling gear, and capture efficiency, with direct observation being difficult at best. Redside Dace, an endangered species native to southern Ontario, has been experiencing population declines as a result of habitat fragmentation. Traditional methods to detect their presence include seining and electrofishing; however, species often go undetected even if present at the site. A novel application of DNA barcoding has been to develop species-specific detection in aquatic habitats from environmental DNA (eDNA). The utility of this methodology was tested at 29 sites where Redside Dace were historically known to be present. The study design assessed several factors for their effects on eDNA detections, including seasonality, temporal versus spatial replicate sampling, and appropriate thresholds for classifying detections versus nondetections (resolving true versus false positive and negative detections). The combined results indicate that eDNA is a reliable method for species detection in freshwater systems, and can be used as an effective sampling technique for documenting occurrences of aquatic endangered species.