**Oral or Poster:** Oral

**Presenter:** Allen, Peter

**Authors:**
Peter J. Allen¹, Erin Brinkman², Wes Baumgartner³, Lora Petrie-Hanson⁴

¹Dept. of Wildlife, Fisheries and Aquaculture, College of Forest Resources, Mississippi State University, Box 9690, Mississippi State, MS 39762
²Dept. of Clinical Sciences, College of Veterinary Medicine, Mississippi State University, Box 6100, Mississippi State, MS 39762
³Dept. of Pathobiology, College of Veterinary Medicine, Mississippi State University, Box 6100, Mississippi State, MS 39762
⁴Dept. of Basic Sciences, College of Veterinary Medicine, Mississippi State University, Box 6100, Mississippi State, MS 39762

**Title:** Fin healing in sturgeon

**Abstract:** Field sampling techniques may cause damage to fins either directly by tissue removal for ageing or genetic purposes or indirectly during capture and handling. To assess how fins heal following different sampling techniques, three different pectoral fin spine/ray treatments were applied (n=8-9 fish/trt): entire leading fin ray removed, a 1-2 cm portion removed near the point of articulation or a 1-2 cm portion removed from a secondary fin ray. All fish were given an injection of an oxytetracycline-based antibiotic into the dorsal musculature following fin treatments, except for an additional group (n=8) that had the entire fin spine removed to assess effects on healing. Following fin section removal, fish from different treatments were mixed equally between three large (4,000-L) recirculating systems, and fin ray healing and mortality were monitored over a 12-month period. In addition, blood samples were collected at 4 months to assess immune system impact, and radiographs were taken at 4, 8 and 12 months to assess the degree of structural healing. Histology of fins was also assessed after 12 months to understand the healing process. Survival was high in all treatments, and healing progressed differently depending on the treatment, with the slowest healing observed in fish with the entire fin spine removed. Results will be discussed in the context of fish health and management.

**Corresponding Author:** peter.allen@msstate.edu
Oral or Poster: Oral

Presenter: Anders, Paul

Co-Authors:
Paul Anders¹*, Jim Dunnigan², Jason Flory³, Greg Hoffman⁴, Sue Ireland⁵, Matt Neufeld⁶, Pete Rust⁷

¹Cramer Fish Sciences, University of Idaho, Moscow, ID., USA. 208.596.9613; anders@fishsciences.net
²Montana Fish Wildlife and Parks, Libby MT., USA.
³U.S. Fish and Wildlife Service, Spokane WA., USA.
⁴US Army Corps of Engineers, Libby MT., USA.
⁵Kootenai Tribe of Idaho, Bonners Ferry, ID., USA.
⁷Idaho Department of Fish and Game, Coeur d’Alene, ID., USA.

Title: Use of a developmental template-based approach to characterize recruitment failure of endangered Kootenai River white sturgeon, with application to other sturgeon populations

Abstract: Sturgeons represent one of the most imperiled groups of fishes worldwide. Many sturgeon populations suffer from recruitment failure (RF), which can result from habitat loss and degradation, altered ecosystem functions, reduced food availability, overharvest, resulting small population sizes, and other causes. We developed and applied a diagnostic template with a seven-step evaluation process to characterize recruitment failure of the endangered Kootenai River white sturgeon population (*Acipenser transmontanus*). As a collaborative effort involving the Kootenai River White Sturgeon Recovery Team and additional sturgeon researchers and managers, this process was used to: 1) summarize and evaluate empirical data, 2) address temporal and spatial RF scoping questions, 3) identify proximal and distal mortality factors, 4) evaluate roles of mortality factors in RF, 5) update the template as needed, 6) develop RF hypotheses, and 7) test hypotheses. Despite annual spawning and production of viable embryos over the past 20 years, RF currently occurs annually due to a spatial mismatch between spawning/incubation habitat requirements and the availability of suitable habitat for eggs, embryos, and free embryos at current spawning locations. Spawning occurs in a low velocity reach dominated by sand and fine substrates (some clay) generally lacking clean, hard surfaces for egg attachment, interstitial space for concealment of incubating embryos from predation, and gas exchange for embryonic metabolism. Although this developmental template approach was specifically designed to diagnose and characterize mortality and RF for Kootenai River white sturgeon, it can also be used to help restore natural recruitment for other imperiled sturgeon populations.

Corresponding Author: anders@fishsciences.net
Oral or Poster: Oral

Presenter: Anderson, Gary

Co-Authors:
Lauren Shute\textsuperscript{1}, Erwin Huebner\textsuperscript{1}, Gary Anderson\textsuperscript{1}

\textsuperscript{1}University of Manitoba

Title: Novel cell types in the integument of larval lake sturgeon

Abstract: The integument in fish is responsible for a variety of physiological functions such as osmoregulation, respiration, nutrient/mineral transport and defense. These roles are most evident during early life history of larval fishes as vital organs such as the gastro-intestinal tract and gills are not fully developed. In this study we have identified and quantified a variety of different cell types on the integument of larval Lake Sturgeon, \textit{Acipenser fulvescens}. Light microscopy in conjunction with scanning and transmission electron microscopy was used to locate, enumerate and describe the different cell types on the integument. Mucous cells, mitochondrial rich cells, keratinocytes and ciliated cells were all identified on the integument of the larval Lake Sturgeon and all demonstrated the classic morphology and intracellular characteristics of these cell types, as identified in other fish species. We also identified two novel cell types. The first cell type was ampullary in shape and had an abundance of Golgi apparatus, rough and smooth endoplasmic reticulum (ER) and clearly defined secretory vesicles being released from a surface pore. There was no sign of any neural connection to this cell type. The second cell type laid on the surface of the epidermis. The cell surface was uneven and these cells had an abundance of Golgi apparatus, rough ER and mitochondria. We propose that based on the characteristics of these cell types they are involved in the synthesis and release of a semiochemical. Whether this chemical acts as a pheromone, alarm signal or defense remains to be determined.

Corresponding Author: Gary.Anderson@umanitoba.ca
Oral or Poster: Oral

Presenter: Apostle, Richard

Co-Authors:
Richard Apostle

1Dalhousie University

Title: Does sturgeon aquaculture serve conservation goals?

Abstract: Aquaculture has a deservedly negative image when questions of conservation arise in the advanced industrial systems. The focus on intensive aquaculture as a means of increasing protein production has led to a long list of negatives, particularly for cage or net aquaculture1[1]. Effluents which sometimes are associated with eutrophication, the impact of escapes in spreading disease, and acting as invasive species, and over-utilization of fish-based meal are among the many legitimate criticisms of the major forms of aquaculture extant in the industrial world. On the other hand, it is true that farmed fish can reduce pressure on wild stocks, and may serve to replenish over-exploited stocks. The debate will continue, and perhaps intensify, as aquaculture advocates will argue that other food production systems are at least as wasteful of energy resources and as destructive of species biodiversity. At this point, there is more intensity than illumination, as we lack direct comparisons of the major food systems upon which we rely. But the fact remains that aquaculture remains “the fastest growing food production system globally”, one upon which the world, industrial or not, will increasingly depend for its food. Of the top 24 species harvested at a level of 1 million t per year, 14 are primarily supplied by aquaculture (Diana, 2009: 27, 29).

Corresponding Author: Richard.Apostle@Dal.Ca
**Oral or Poster: Oral**

**Presenter:** Auer, Nancy

**Co-Authors:**
Nancy A. Auer¹, Jeremy G. Olach¹, Edward Baker²

¹Department of Biological Sciences, Michigan Technological University, 1400 Townsend Drive, Houghton, Michigan 49931, USA  
²Marquette Fisheries Research Station, Michigan Department of Natural Resources  
488 Cherry Creek Road, Marquette, Michigan 49855

**Title:** Translocation and telemetry tracking of lake sturgeon in the Menominee River, Michigan and Wisconsin

**Abstract:** The Menominee River, a MI-WI boundary water, contains a fragmented population of lake sturgeon (*Acipenser fulvescens*) due to construction of several hydroelectric dams built in the early 1900s. Fish passage is currently being implemented on the lower dams, yet it is unclear whether sturgeon given access to historic spawning grounds would use them. In 2012 and 2013, a total of 15 pre-spawning sturgeon were captured, implanted with sonic transmitters and translocated upstream over two hydroelectric dams to a section of river known as a historic spawning site Sturgeon Falls. Movements of sturgeon were then followed using five stationary receivers and a portable receiver. Measures of abiotic habitat features included water depth and temperature, substrate particle class, dissolved oxygen, and light intensity, while biotic components included invertebrate identification and vegetation mapping. Within two weeks of translocation, seven of the tagged sturgeon were detected near the historic spawning site. Lake sturgeon spawning behavior was observed at this site both years. Within 48 hours of translocation the remaining 8 study sturgeon all migrated at least 10 rkm upstream, near two other potential spawning sites within the study area. Growth of vegetation was dominated by wild celery and this appeared to create a barrier to sturgeon movement in 2012 covering 27% of study area, but did not in 2013 when vegetation covered 13% and flows were higher. Pre-spawning sturgeon moved from an impounded stretch of river and given access to the historic upstream spawning habitat will migrate to this habitat.

**Corresponding Author:** naauer@mtu.edu
Oral or Poster: Oral

Presenter: Baker, Edward

Co-Authors:
Edward A Baker*1, Kim T. Scribner2

1 Michigan Department of Natural Resources, 488 Cherry Creek Rd., Marquette, MI 49855, (906) 249-1611
2 Michigan State University

Title: Estimation of cohort-specific first year survival and evaluation of lake sturgeon stocking in Black Lake, Michigan

Abstract: Stocking is increasingly being employed to rehabilitate and restore Lake Sturgeon (Acipenser fulvescens) populations around the Great Lakes and elsewhere. However, there is little information available to guide stocking decisions such as the appropriate number or age/size of fish to stock, post-stocking survival, etc. As part of ongoing evaluations of a long-term lake sturgeon restoration stocking program in Black Lake, Michigan, we conducted a gillnet survey in 2013 and employed a multiple-mark multiple-recapture population abundance estimator. We collected demographic data and determined fish age based on the presence and location of coded wire tags and pectoral fin-ray cross sections. We determined year-class specific abundance, overall survival from the year of stocking to 2013 for six cohorts, and year-class specific survival from age-0 to age-1 of stocked fish based on the known number stocked and compositional age estimates of the survey catch. Survival from year of stocking to 2013 ranged from 0.03-0.53 across the cohorts sampled. Assuming constant survival for age-1 and older fish, post-stocking survival from age-0 to age-1 ranged from 0.05-0.84 and increased with increasing size of fish at stocking. Based on stocked fish abundance and survival estimates, annual stocking targets for the Black Lake population were established to meet long-term management goals for adult abundance.

Corresponding Author: bakere1@michigan.gov
Oral or Poster: Oral

Presenter: Baker, Edward

Co-Authors:
Edward A Baker¹*, Kim T Scribner², Shirley Pledger³

¹Michigan Department of Natural Resources
²Michigan State University
³Victoria University of Wellington

Title: Evaluation of a spawning return-time mark-recapture model for estimating lake sturgeon population parameters

Abstract: Effective management of lake sturgeon (Acipenser fulvescens) is hampered by a lack of basic information (e.g. abundance, mortality rates, etc.) on current populations. Until recently there was no appropriate model to apply to mark-recapture data collected from spawning sturgeon that accounted for the intermittent and highly variable spawning times of males and females. Using an 11 year mark-recapture dataset of spawning lake sturgeon we developed a model that accounts for spawning return-time that can be used to estimate population abundance, annual survival, and other population-level parameters. We will briefly describe the new model and then simulate various sampling scenarios using our long-term dataset to determine model performance under varying levels of annual sampling effort, intermittency, and years of sampling that reflect assessment scenarios managers face. We will then compare simulated sampling scenario results to return-time model output from the full dataset. Based on the result-comparisons between the various simulated sampling scenarios and the full dataset results we will provide advice for managers designing sampling programs for mark-recapture sampling of spawning lake sturgeon and other long-lived iteroparous species.

Corresponding Author: bakere1@michigan.gov
Oral or Poster: Oral

Presenter: Barth, Cam

Co-Authors:
C. C. Barth¹, C. A. McDougall¹, and P. A. Nelson¹

¹North/South Consultants Inc., 83 Scurfield Blvd., Winnipeg, Manitoba R3Y 1G4

Title: Determinants of lake sturgeon (*Acipenser fulvescens*) growth: Insights from Manitoba waterbodies

Abstract: Previous research on growth rate variation in Lake Sturgeon attempted to correlate size-at-age data from multiple populations across the species range with abiotic factors including: latitude, longitude, mean annual air temperature, pH, and conductivity. The current paradigm suggests that growth generally decreases with latitude and that mean annual air temperature may be the best overall predictor of individual growth, a key parameter associated with species recovery modelling. We synthesized growth data of juveniles (≤ 14 years) from 23 Lake Sturgeon subpopulations captured in five Manitoba rivers (Winnipeg, Burntwood, Nelson, Churchill and Hayes). Length-at-age varied markedly among the subpopulations, including those from geographically close river sections where subpopulations are separated only by habitat transitions (falls, rapids, river narrows or dams). Growth metrics were not correlated with mean annual air temperature, latitude, longitude, pH, conductivity, total nitrogen, total phosphorus, chlorophyll, turbidity, hardness, and dissolved organic carbon. On a broad geographic scale, latitude and/or mean annual air temperature may be generally predictive of Lake Sturgeon growth rates; however, based on the results from Manitoba rivers, it is clear that other factors are influential. We explore the potential for density dependant effects and offer an alternate hypothesis: Lake Sturgeon growth rate at the juvenile stage is influenced by water velocity, likely due to fish energetics, and/or in-situ productivity.

Corresponding Author: CBarth@nscons.ca
Oral or Poster: Oral

Presenter: Bauman, John

Authors:
John M. Bauman\textsuperscript{1}, Edward A. Bake\textsuperscript{2}, Terry L. Marsh\textsuperscript{3}, Kim T. Scribner\textsuperscript{1,4}

\textsuperscript{1}Department of Fisheries and Wildlife, Michigan State University, 13 Natural Resources Building, East Lansing, MI 48824, USA.
\textsuperscript{2}Michigan Department of Natural Resources Fisheries Division, 484 Cherry Creek Road, Marquette, MI 49855, USA.
\textsuperscript{3}Department of Microbial and Molecular Genetics, Michigan State University 6169 Biomedical Physical Sciences, East Lansing, MI 48824, USA.
\textsuperscript{4}Department of Zoology, Michigan State University 288 Farm Lane, East Lansing, MI 48824, USA.

Title: Effects of different chemotherapeutant prophylactics on the survival of lake sturgeon

Abstract: In aquaculture settings, including use of stream-side hatchery facilities and surface water, stress resulting from standard rearing conditions (e.g., water quality, crowding, food, etc) or common production practices (e.g., handling) can interfere with physiological processes that aid in the defense against pathogens. Therefore, development of therapeutic treatment protocols that limit stress-induced infection or that reduces high levels of mortality in aquaculture settings is essential to successful fish production. Survival of Lake Sturgeon (\textit{Acipenser fulvescens}) was quantified from 14 to 49 days post-exogenous feeding under different treatment regimes. A significant effect of chemotherapeutant prophylactics on mean proportional survival of lake sturgeon was documented. Proportional survival (0.83 ±0.03, mean ±SE) in groups treated weekly with 3 ppt sodium chloride followed 24 hr later by 60 mg/L hydrogen peroxide was significantly higher than the mean proportional survival (0.38 ±0.09, 0.51 ±0.06) in groups treated with either 15 mg/L chloramine-T or 60 mg/L hydrogen peroxide (respectively). Results from this study can be used to develop standard operating procedures for rearing lake sturgeon, a species of conservation concern.

Corresponding Author: baumanj7@msu.edu
Title: A scientific basis for restoring fish spawning habitat in the St. Clair and Detroit Rivers of the Laurentian Great Lakes

Abstract: Loss of functional habitat in riverine systems is a global fisheries issue. Few studies, however, describe the decision-making approach taken to abate loss of fish spawning habitat. Numerous habitat restoration efforts are underway and documentation of successful restoration techniques for spawning habitat of desirable fish species in large rivers connecting the Laurentian Great Lakes are reported here. In 2003, to compensate for loss of fish spawning habitat in the St. Clair and Detroit Rivers that connect the Great Lakes Huron and Erie, an international partnership of state, federal, and academic scientists began restoring fish spawning habitat in both of these rivers. Using an adaptive management approach, we have completed five reef construction projects in the system, with another underway, and potentially two more projects to be completed in the near future. Here, we describe the adaptive-feedback management approach that we used to guide our decision making during all phases of spawning habitat restoration, including problem identification, team building, hypothesis development, strategy development, prioritization of physical and biological imperatives, project implementation, habitat construction, monitoring of fish use of the constructed spawning habitats, and communication of research results. Numerous scientific and economic lessons learned from 10 years of planning, building, and assessing fish use of these fish spawning habitat restoration projects are summarized.

Corresponding Author: james_boase@fws.gov
Title: Assigning sex and reproductive stage to adult lake sturgeon using ultrasonography and common morphological measurements

Abstract: Sex determination of fish species is difficult to assess when sexual dimorphism and gametes are not apparent. For threatened and endangered fish species, unobtrusive techniques are needed when determining sex to minimize stress and the potential for mortality. The current study evaluates the use of a portable ultrasound unit to determine sex of Lake Sturgeon in the field. Ultrasound images were collected from 9 yellow-egg (F2, F3), 32 black-egg (F4, F5), and 107 fully-developed male (M2) Lake Sturgeon. Sex was accurately assigned 88 - 96% of the time; however accuracy depended on maturity. Black-egg females and fully-developed males were correctly identified 89 – 100% of the time, while yellow-egg females only 33% and 67% of the time. Sex and maturity determined from ultrasound images and visual inspection of the gonads did not vary with reader. Time spent collecting images ranged between 2 - 3 minutes once comfortable with operating procedures. Discriminant analysis revealed the total length/girth ratio was a strong predictor of sex and maturity, correctly classifying 81% of black-egg females and 97% fully-developed males. However, yellow-egg females were incorrectly classified on all occasions. This work shows the utility of using ultrasonography and a total length/girth ratio for sex determination of lake sturgeon in later reproductive stages around the spawning season.
Oral or Poster: Oral

Presenter: Bolden, Stephania

Co-Authors:
Stephania Bolden¹

¹ NOAA Fisheries, 263 13th Avenue South, St. Petersburg, Florida 33701

Title: Partnering for mortality: A tale of Gulf sturgeon cooperation

Abstract: In 2009 the Gulf sturgeon (Acipenser oxyrinchus desotoi) community organized efforts to standardize survey protocols and monitoring procedures to fulfill the needs of future stock assessment. This collective effort included personnel from both federal and state agencies and academia working with a species listed under the Endangered Species Act. The focus of the 5-year effort was to provide critical data required to estimate mortality while facilitating research objectives of many. Methods include: acoustic telemetry; PIT tagging; and simulation-tested, multi-state mark-recapture models. Mid-term results were positive and indicated natural mortality varied across geographic range. Conclusions and management recommendations will be discussed.

Corresponding Author: Stephania.bolden@noaa.gov
Oral or Poster: Oral

Presenter: Brown, Brandon

Co-Authors:
Brown, Brandon

1 Oklahoma Department of Wildlife Conservation, 61091 E 120 Rd Miami, OK 74354

Title: An overview of Oklahoma’s paddlefish research center

Abstract: Paddlefish Polyodon spathula research and management efforts by state fish and wildlife agencies have traditionally been hindered by limited funding and higher prioritization of more popular sportfish species. The Oklahoma Department of Wildlife Conservation (ODWC) has made significant progress overcoming these obstacles with the implementation of a self-funded paddlefish management program. The program provides much needed data for paddlefish management and as an unconventional by-product, revenue which funds the program and other fish and wildlife projects throughout the state. The Paddlefish Research Center (PRC) is the heart of the program and serves as a paddlefish research station and a fish and caviar processing and packaging facility. The PRC is modeled after similar programs in Montana and North Dakota and utilizes angler caught paddlefish to collect biological data such as length, weight, gonadal fat and dentary bones. In return for participation, PRC staff fillet and package the anglers catch free of charge. Roe from female paddlefish are processed into caviar, which are auctioned to provide funding for the program. Benefits of the program include increased paddlefish research and law enforcement efforts, heightened public awareness, and the implementation of several harvest regulations.

Corresponding Author: Brandon.brown@odwc.ok.gov
Oral or Poster: Oral

Presenter: Bruch, Ronald

Co-Authors:
Ryan P. Koenigs¹; Ronald M. Bruch¹*

¹ Wisconsin Department of Natural Resources; Bureau of Fisheries Management; Oshkosh, WI

Title: Age estimation and validation techniques for Acipenserids

Abstract: Age estimation is a principal component of effective fisheries management, particularly as it relates to long lived species of the family Acipenseridae. Age data are applied to growth, mortality, and statistical catch at age models, and model outputs are only as accurate as the data incorporated into the model. Therefore, it is imperative to collect the most accurate data possible and use caution when applying biased age data. Extensive peer-reviewed literature has compared precision of age estimates between structures, but few studies have investigated the accuracy of age estimates for sturgeon species. Here we review the literature related to sturgeon age estimation, while also demonstrating the distinct differences between precision and accuracy. Additionally, we highlight techniques for validating the accuracy of otolith and pectoral fin spine age estimates for lake sturgeon on the Winnebago System including bomb radio carbon analysis and recapture of known-age hatchery reared fish after 10-16 years at liberty in the wild. Lastly, we simulate the management implications of incorporating inaccurate data into population dynamics modeling for long-lived fish species.

Corresponding Author: Ronaldmbruch@gmail.com
Oral or Poster: Oral

Presenter: Burchfield, Jim

Co-Authors:
Jim Burchfield*, Brian McLaren

*Faculty of Natural Resources Management, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario P7B 5E1 Canada

Title: Diet and habitat use by juvenile lake sturgeon in the Namakan River, Northwestern Ontario, Canada

Abstract: Knowledge of the habitat use of juvenile lake sturgeon (*Acipenser fulvescens*) is a priority for the conservation of the species. Behaviour and habitat across parts of their range have been described in a number of previous studies. This study expands this knowledge to the Namakan River, an unmanaged spawning river in Northern Ontario, Canada which serves as an example Canadian Shield stream in which to relate juvenile lake sturgeon diet to habitat use. In 2010, ten juvenile lake sturgeon were tagged with Vemco acoustic transmitters and monitored by a Vemco VPS array within a juvenile nursery area for two years as part of a joint effort between Lakehead University, the Ontario Ministry of Natural Resources, and Voyageur’s National Park. We conducted habitat surveys of the area using side scanning sonar, Ekman dredges, and an epibenthic sled outfitted with a video camera between 2013 and 2015. Additional gillnet sampling was conducted to verify continued use of the nursery hole and to collect gut contents using gastric lavage. Juveniles were stationary much of the time and used areas dominated by large rocky substrate more than expected, with intermediate use of coarse sandy substrates, and virtually no use of fine sand or clay. Summer juvenile diet varied considerably with Trichoptera and Ephemeroptera larvae well represented. Daphnia, amphipods, and bivalves were atypical, but were main components of one individual’s diet. We suggest that the use of hard substrates by Ephemeroptera and Trichoptera explains the increased use of these substrates by Namakan River juvenile sturgeon.

Corresponding Author: jburchfi@lakeheadu.ca
Oral or Poster: Oral

Presenter: Buszkiewicz, John

Co-Authors:
John Buszkiewicz\(^1\), Sara Tripp\(^2\), Quinton Phelps\(^2\) and Dave Herzog\(^2\)

\(^1\)Southeast Missouri State University, Department of Biology
\(^2\)Missouri Department of Conservation, Big Rivers and Wetlands Field Station

Title: Lake sturgeon reproductive ecology in the upper Mississippi River

Abstract: Lake Sturgeon (*Acipenser fulvescens*) is a fish species which is currently protected from harvest and considered rare in the Upper Mississippi River and endangered in Missouri. Habitat fragmentation and overexploitation has led to historic population declines. Even though management efforts have been effective in assessing population increases through stocking programs, spawning success in the Upper Mississippi River has historically been undocumented. Since the presence of embryos or larvae has previously been unconfirmed in this region, the three main objectives of this project was to identify Lake Sturgeon spawning aggregations, confirm the presence of embryos or larvae near these aggregations, and to characterize the habitat of these spawning locations. Gillnets and trotlines were used to sample adult Lake Sturgeon, which were subsequently implanted with ultrasonic transmitters. In areas where spawning aggregations occurred, embryos were collected and hatched in the laboratory. Genetic testing of the progeny has confirmed the initial species identification and will offer insight as to which specific brood stock contributed to this spawning event. Fine mesh trawling surveys were also conducted to assess recruitment success and habitat use of larval sturgeon species. The information presented in this study will further develop existing knowledge of Lake Sturgeon reproductive ecology which will ultimately enhance natural reproduction of Lake Sturgeon in the Upper Mississippi River.

Corresponding Author: Buszkiewiczj@gmail.com
Oral or Poster: Oral

Presenter: Ceapa, Cornel

Authors: Michael Dadswell¹, Cornel Ceapa², Rod Bradford³, Allen Curry⁴, Michael Stokesbury¹

¹Acadia University, Nova Scotia, Canada
²Acadian Sturgeon and Caviar Inc., New Brunswick, Canada
³Population Ecology Division, Science Branch, Fisheries and Oceans Canada, Nova Scotia, Canada
⁴University of New Brunswick in Fredericton, New Brunswick, Canada

Title: The Atlantic sturgeon stock of the Saint John River, New Brunswick, Canada

Abstract: The Saint John River Atlantic sturgeon fishery exists since 1880. The stock was fished without restriction from 1880 to 1886 until the adult population was depleted. In 1887 the fishery was closed for 10 years and then reopened with a season (closed during June), gear restriction (33 cm gill nets) and a size limit (122 cm total length). During 1998-2008 the fishery was largely unexploited due to lack of markets. The fishery was reinitiated in 2009 but with a quota of 350 adults/yr (175 males and 175 females). Since 2009 biological characteristics for every captured sturgeon were taken (length, sex, etc.) and during this period 34 - 47 % of captured adults were tagged and released each year. There has been a total of 1106 adults marked and 116 tag returns in subsequent years. Tag returns indicate males return to spawn every 2-3 years and females every 4-5 years. A closed population, modified Schnabel estimate of the total adult stock in 2014 was 11,557 (95% CL 9,234 – 14,907). The 2014 adult population size is similar to the 1880 stock size (~11,000 adults) determined using the 1880–1886 landings data and a Leslie Model with an average weight/sturgeon of 50 kg. The quota of 350 adults/yr represents an exploitation rate (u) of 2.9 % of the total adult population and the Beverton-Holt Model indicates this is well within the range of equilibrium yield. These data suggest the stock is now at the carrying capacity and the sturgeon fishery is sustainable.

Corresponding Author: cceapa@acadian-sturgeon.com
Oral or Poster: Oral

Presenter: Chojnacki, Kimberly

Co-Authors:
Kimberly A. Chojnacki\textsuperscript{1}, Edward A. Bulliner\textsuperscript{1}, Susannah O. Erwin\textsuperscript{1}, Amy E. George\textsuperscript{1}, David K. Combs\textsuperscript{1}, Jake D. A. Faulkner\textsuperscript{1}, and Aaron J. DeLonay\textsuperscript{1}

\textsuperscript{1}U.S. Geological Survey, Columbia Environmental Research Center, 4200 New Haven Road, Columbia, MO 65201

Title: Developing a model to identify successful \textit{Scaphirhynchus} sturgeon spawning locations using free embryos collected from the lower Missouri and Platte Rivers

Abstract: Identifying where and when sturgeons successfully spawn in relation to suitable habitat and environmental conditions is critical to implementing effective management actions on the Lower Missouri River. To better understand the spatial and temporal distribution of pallid sturgeon (\textit{Scaphirhynchus albus}) and shovelnose sturgeon (\textit{Scaphirhynchus platorynchus}) spawning in the Lower Missouri River, we sampled weekly for drifting free embryos from 2012 through 2014. During 2012, we sampled for sturgeon free embryos in the Missouri River at river mile 33.3 near St. Charles, Missouri. During 2013 and 2014 we sampled two sites south of Omaha, Nebraska near the confluence of the Missouri and Platte Rivers; one site was located in the Missouri River at river mile 599.5, upstream of the confluence with the Platte River, and the second site was located in the Platte River less than one mile upstream from the confluence with the Missouri River. Using sample location and estimated age of the free embryos collected from 2012 through 2014, we developed a routing model to estimate the probable location of upstream spawning events, including the possibility of hatching in select tributaries. The model, coded in Python and ArcGIS, utilizes a river network generated from National Hydrological Database version 2 data. The model identifies and downloads relevant USGS gage discharge records, and modeled average channel velocities are used to calculate estimated drift distance of free embryos. Our model includes features to account for variations in encountered velocities and uncertainties in age estimations, and can be easily modified to incorporate additional river segments.

Corresponding Author: kchojnacki@usgs.gov
Oral or Poster: Oral

Presenter: Crossman, James

Co-Authors:
James A. Crossman¹, Larry R. Hildebrand²

¹BC Hydro, Environmental Risk Management, 601 18th Street, Castlegar, BC, V1N 2N1, Canada,
²Golder Associates Ltd., 201 Columbia Ave., Castlegar BC, V1N 1A8

Title: Factors influencing survival and growth of hatchery-reared juvenile white sturgeon released into the upper Columbia River, Canada from 2002-2014.

Abstract: Conservation aquaculture has become a critical component of recovery programs, including for White Sturgeon (Acipenser transmontanus) in the upper Columbia River Canada where extirpation has largely been avoided due to the success of hatchery-reared juveniles released into the wild. However, data are required on survival and growth to inform recovery goals and meet long-term population targets. This study describes the apparent survival and growth dynamics of hatchery-reared juvenile White Sturgeon based on a 10 year mark-recapture program. Hatchery-reared juveniles (n=136,942) have been released annually at varying ages, sizes, and numbers since 2002. We used a selection of Cormack-Jolly-Seber models to estimate apparent survival rates and recapture probabilities of hatchery-reared juvenile White Sturgeon at large. Annual growth in length and weight was predicted using von Bertalanffy models to assess if density dependent effects on growth were occurring with increased numbers of stocked fish. The hatchery population in the upper Columbia River was estimated to have increased from an initial 8,700 individuals to approximately 32,000 after 12 years of supplementation. First year survival was significantly influenced by size-at-release, with juvenile White Sturgeon released at 100, 200, and 300 g having estimated survival rates of 0.48, 0.86, and 0.98, respectively. Juveniles released in the first year the stocking program was initiated had the highest survival at >0.90 for fish >100 g. Annual growth in length for younger cohorts (<5 years of age) following release decreased with increased numbers of juveniles at large. Results of this study indicate survival of hatchery-reared juveniles has been higher than originally predicted; this has modified recovery actions for the upper Columbia population by releasing progeny at a minimum size that improves survival and focusing on ways to maximize genetic diversity.

Corresponding Author: James.Crossman@bchydro.com
Oral or Poster: Oral

Presenter: Dammerman, Kari

Co-Authors:
K.J. Dammerman¹ (presenting), M.A.H. Webb², K.T. Scribner¹,³

¹Department of Zoology, Michigan State University, 228 Farm Lane Rm 203, East Lansing, MI 48824, USA
²Bozeman Fish Technology Center, U.S. Fish and Wildlife Service, 4050 Bridger Canyon Rd, Bozeman, MT 59715
³Department of Fisheries and Wildlife, Michigan State University, 480 Wilson Road Rm 13, East Lansing, MI 48824

Title: Associations between egg quality, behavioral plasticity, and reproductive success of spawning female lake sturgeon

Abstract: Predicting potential population levels of recruitment require an understanding of the factors affecting spatial and temporal variation in spawning activities and variance in individual reproductive success (RS). Environmental conditions and life-history traits such as age, size, and operational sex ratio (OSR) are well-documented influences on spawning behavior and RS. However, the effect of individual variation in female reproductive timing on egg quality and RS is unclear. In 2012 and 2013, we captured spawning adult lake sturgeon (N=519; Acipenser fulvescens) among seven spawning locations in the Black River, Michigan. We recorded body length, sex, and individually marked fish using PIT and Floy tags. Location, number of males present with females, OSR, discharge and temperature were recorded daily. Blood was taken daily from females in 2013. RS was estimated by genotyping offspring captured during larval surveys. Timing of spawning was influenced by temperature, discharge, number of males present, and average body length of males. Egg quality varied between females, but was not influenced by days spent in the river. Female RS varied due to temperature, discharge, group size, and OSR. Results indicate that plasticity in female spawning time may affect egg quality, but female RS is largely influenced by environmental conditions and access to mates which are increasingly variable in riverine systems.

Corresponding Author: kjdammerman@gmail.com
Oral or Poster: Oral

Presenter: DeLonay, Aaron

Co-Authors:
Aaron J. DeLonay¹, Kimberly A. Chojnacki¹, Jake D. A. Faulkner¹, James S. Candrl¹, David K. Combs¹

¹U.S. Geological Survey, Columbia Environmental Research Center, 4200 New Haven Road, Columbia, Missouri

Title: Comparative studies of the initiation of drift behavior by three sturgeon species in an experimental stream

Abstract: Pallid Sturgeon (Scaphirhynchus albus) are endangered and shovelnose sturgeon (S. platorynchus) are declining, possibly due to fragmentation and alteration of habitat that reduces spawning success. These species are thought to spawn over coarse substrate, depositing adhesive eggs that develop on the substrate or in interstitial spaces. Field collections of free embryos suggest that dispersal for these species occurs immediately upon hatch. To confirm inferences from field data, we examined the initial dispersal of free embryos of two Scaphirhynchus and one Acipenser species in experimental streams. Lake Sturgeon (Acipenser fulvescens) were included for comparison as delayed drift and retention in substrate had been described previously for this species. In separate studies, newly hatched free embryos of each species were placed in three outdoor streams. Each stream contained 8-meter randomly placed sections of gravel and cobble. A total of 800 free embryos was placed in each substrate section within a stream. Dispersing free embryos were collected in ichthyoplankton nets downstream of each substrate treatment. Collected embryos were counted and preserved at 1 to 6-hour intervals. Experiments were terminated after 96 hours and all substrate removed to collect embryos remaining in interstitial spaces. Dispersal and retention were evaluated, and percent recovery of free embryos was calculated at the end of the experiment. Recovery of free embryos from all species was high. Newly hatched lake sturgeon did not disperse during the 96-hour study (>99% retention). In contrast dispersal of pallid and shovelnose sturgeon was immediate with >85% downstream recovery of embryos within 6 hours.

Corresponding Author: adelonay@usgs.gov
**Oral or Poster: Oral**

**Presenter:** Deslauriers, David

**Co-Authors:**
David Deslauriers¹, Laura Heironimus², Tobias Rapp³, Brian D.S. Graeb¹, Robert A. Klumb⁴, Steven R. Chipps¹,⁵

¹. Department of Natural Resource Management, South Dakota State University, Box 2140B, SNP 138, Brookings, South Dakota, 57007-1696, United States
². U.S. Fish and Wildlife Services, Lodi Fish and Wildlife Office
³. Department of Biology and Ecology, Leibniz-Institute for Freshwater Ecology and Inland Fisheries
⁴. U.S. Fish and Wildlife Services, Great Plains Fish and Wildlife Management Assistance Office
⁵. U.S. Geological Survey, South Dakota Cooperative Fish and Wildlife Research Unit

**Title:** Applicability of SEAPS (Site Evaluation App for Pallid Sturgeon) to determine growth potential of age-0 pallid sturgeon in the Missouri River

**Abstract:** Habitat requirements for early life stages of the federally endangered Pallid Sturgeon (*Scaphirhynchus albus*) are poorly understood. To deal with this uncertainty, a growth model incorporating foraging dynamics (functional feeding response, satiation, gut evacuation rate) and energetics (respiration, activity, waste) was recently developed. The model was shown to perform well under a wide range of temperatures (14-24°C) and fish sizes (19-70 mm) when evaluated in laboratory environments mimicking natural conditions. The purpose of the model was to allow researchers the ability to evaluate habitat quality and simulate growth of age-0 Pallid Sturgeon under natural conditions in the Missouri River. Consequently, a new software application (through RStudio Shiny) was developed to apply the model and to facilitate user-friendliness. In this presentation, the application (SEAPS) will be introduced and general functionality will be demonstrated. Additionally, empirical data requirements (water temperature and velocity, prey density) and data format needs for the evaluation of spatially explicit growth patterns for age-0 Pallid Sturgeon will be presented. The application should prove useful for identifying important rearing areas or habitats that might act as bottlenecks to the recruitment of Pallid Sturgeon.

**Corresponding Author:** david.deslauriers@sdstate.edu
Oral or Poster: Oral

Presenter: DiJohnson, Alexander

Co-Authors:
Alexander M. DiJohnson¹, Lori M. Brown¹, Matthew T. Fisher², and Dewayne A. Fox¹

¹Delaware State University, Department of Agriculture and Natural Resources, 1200 North DuPont Highway, Dover, DE 19901
²Virginia Commonwealth University, VCU Life Sciences, 1000 West Cary Street, Richmond, VA 23284-2030

Title: Behavioral response of adult Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus) to commercial shipping in the Delaware River

Abstract: Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) populations along the US east coast were listed under the provisions of the ESA in 2012. Mortalities due to vessel strikes which peak during spawning months were noted as a threat by the NOAA-NMFS for the Delaware River. To address this threat, we monitored the fine-scale movement patterns of Atlantic Sturgeon in a 5.2km stretch of river containing likely spawning/staging habitats near Chester, Pennsylvania through the use of a VEMCO Ltd. Positioning System (VPS) in 2013. The VPS was expanded in 2015 to 6.5km to incorporate an adjacent anchorage wherein individuals were detected, but were just out of range. Shipping activity was assessed through the global Automatic Identification System which provided vessel type, position, course, and speed. During the time of presumed spawning (mid-late April to early-mid July) in 2013, five telemetered adult Atlantic Sturgeon were observed concurrent with 102 vessels in the VPS. Atlantic Sturgeon position estimates were densest along the edge of the shipping channel. Atlantic Sturgeon trajectories were used to examine attraction or avoidance to vessels between set time frames (before vessels entered the area, while vessels were in the area, and after vessels left the area). We hope to determine which areas adult Atlantic Sturgeon utilize during presumed spawning and how vessel traffic impacts their behaviors. This research will provide managers with information concerning the reactive behavior of Atlantic Sturgeon to commercial shipping as well as by identifying areas in which collisions are highest within the Delaware River.

Corresponding Author: dijoham07@gmail.com
**Oral or Poster: Oral**

**Presenter:** Dittman, Dawn

**Co-Authors:**
Dawn Dittman¹, Ross Abbett², Jeff Wyatt³, and William Evans⁴

¹USGS, Tunison Laboratory of Aquatic Science, 3075 Gracie Road, Cortland NY 13045,
²IAP Worldwide Services, Tunison Laboratory of Aquatic Science, 3075 Gracie Road, Cortland NY 13045
³Wildlife Health & Conservation-Seneca Park Zoo, 2222 St Paul Street, Rochester, NY 14641
⁴NYS DEC, Oneida Fish Hatchery, Constantia, NY 13044

**Title:** First year survival of stocked lake sturgeon in the Genesee River, New York

**Abstract:** Lake Sturgeon (*Acipenser fulvescens*) restoration programs routinely employ young of year (YOY) stocking as a tool for local population enhancement. This is an integral management strategy for conservation of the Lake Sturgeon metapopulation. An element of modeling the projected effectiveness of supplementation strategies is 1st year survival. However, there has been limited direct survivorship assessment through age one of stocked Lake Sturgeon. In October 2013, we released 1,047 YOY (average length 229mm, weight 48.8g), 123 uniquely tagged, into the Genesee River, NY. We collected six capture-recapture samples from June 2014 through October 2014. A total of 135 were captured with 23 recaptures. As a first population estimator we applied a modified Schnabel model. As of October 2014, an estimated nine hundred and sixty 2013 year class Lake Sturgeon resided in the Genesee River. Thus, an estimated 93.5% of the fish stocked in October 2013 were still present a year later. This estimate of survivorship is much higher than the survivorship levels currently used in many stocking planning models. Further analysis with open population mark-recapture models and comparison with the Genesee River survivorship of 2003 and 2004 released young of year Sturgeon provide a more precise estimation of between stocking year survivorship. These results will allow a better understanding of the levels of survivorship at this life stage and the factors (habitat, size at stocking, condition, river characteristics, etc.) which may influence the number of stocked Lake Sturgeon living through their first year in restoration waters.

**Corresponding Author:** ddittman@usgs.gov
Oral or Poster: Oral

Presenter: Donofrio, Michael

Co-Authors:
Michael Donofrio¹, Kim Scribner², Edward Baker³, Robert Elliott⁴

¹Wisconsin Department of Natural Resources, 101 North Ogden Road, Peshtigo, WI 715-582-5050
²Michigan State University
³Michigan Department of Natural Resources
⁴U.S. Fish and Wildlife Service

Title: Spawning fidelity of lake sturgeon in Green Bay Rivers

Abstract: Spawning river fidelity of lake sturgeon (Acipenser fulvescens) is difficult to assign considering variability of spawning intervals and the complexity of conducting assessments on large waterbodies with multiple spawning rivers, like Green Bay. In addition, movement patterns of adult sturgeon are likely impacted due to a relatively small population size compared to historic estimates (< 1%) and hydroelectric dams on most rivers which have altered spawning behavior. We used a direct, acoustic telemetry, and indirect, genetic assignments, to determine the spawning fidelity of lake sturgeon in four Green Bay Rivers. From 2011-15, we collected and sexed 115 spawning lake sturgeon then surgically implanted Vemco V-16 transmitters into fish from the Menominee, Peshtigo, Oconto and Fox rivers of Green Bay. Those tags are viable for 8-10 years. Tissue samples from each lake sturgeon were analyzed and genetically assigned to a designated Great Lakes population. Multiple acoustic receivers in each river allowed us to identify seasonal and directional movement patterns of each sturgeon for multiple years. To date, 31% of the study fish have returned in a subsequent year to a spawning area in these 4 rivers. Of the returning sturgeon, 89% of those fish were males. Genotypic assignments corroborated that 88% of the implanted fish returned to the river where they were tagged and it appears from our acoustic telemetry data that limited straying (3%) of these spawning stocks occurred during subsequent spring spawning periods. Significantly higher rates (19%) of straying between rivers occurred during non-spawning months. This study won’t conclude until 2025 and therefore management recommendations would be pre-mature.

Corresponding Author: michael.donofrio@wisconsin.gov
Oral or Poster: Oral

Presenter: Doukakis-Leslie, Phaedra

Co-Authors:
Phaedra Doukakis-Leslie¹, Susan Wang¹, Ethan Mora², Steve Lindley³

¹Ocean Associates, Inc., NOAA NMFS West Coast Region, 501 W Ocean Blvd # 4200, Long Beach, California 90802; (858) 334 2838
Susan Wang, NOAA NMFS West Coast Region
²UC Davis
³NOAA NMFS Southwest Fisheries Science Center

Title: Green sturgeon five-year status update and post-release survival research

Abstract: The Southern Distinct Population Segment (SDPS) North American green sturgeon (Acipenser medirostris) is considered a Threatened species under the Endangered Species Act while the Northern DPS is considered a Species of Concern. Five-year status review updates for both DPSs were recently undertaken and reveal progress in our knowledge about the species and threats, as well as gaps that need to be addressed to inform effective management and recovery. These include abundance estimation, juvenile recruitment, survival, and habitat use, and post-release survival rates for fisheries bycatch, among others. Here, we briefly highlight the findings of the five-year status update and discuss a specific project that we are undertaking to better characterize fisheries by-catch post-release survival. The project is being conducted collaboratively with the NOAA Observer Program and the CA halibut fishery to measure post-release survival of green sturgeon encountered in the fishery. The challenges of the project include effectively studying small subadult green sturgeon without introducing additional sources of stress thereby impacting post-release survival. We further discuss what we currently know about fisheries by-catch across the range of the species and why post-release survival studies are particularly important.

Corresponding Author: phaedra.doukakis@noaa.gov
Oral or Poster: Oral

Presenter: Elliott, Robert

Authors:
Robert F. Elliott, Rory Alsberg, Denny Canef, Mike Donofrio, James Fossum, Darren Kramer, Kyle Krueger, Nick Utrup

1U.S. Fish and Wildlife Service
2Eagle Creek Renewable Energy
3River Alliance of Wisconsin
4Wisconsin Department of Natural Resources
5Michigan Department of Natural Resources

Title: Lake sturgeon passage on the Menominee River - a habitat based partnership

Abstract: Lake Michigan supports at least 9 naturally reproducing populations of lake sturgeon that migrate up major rivers to spawn. These rivers provide important rearing habitat that young sturgeon use before they migrate downstream into coastal waters of Lake Michigan. The largest of these populations spawns in the Menominee River. Prior to the construction of dams in the mid-1800s, sturgeon could migrate 132 kilometers up and down the Menominee River and spawn at several major rapids. Today, this river section is impounded by 5 hydroelectric dams, the first two located 4.3 and 6.1 Km from the river mouth. Habitat inventories conducted in 2004-5 quantified contemporary spawning and juvenile rearing habitat in the Menominee and in 5 other Lake Michigan sturgeon rivers. While spawning and juvenile rearing habitat is abundant in the Menominee River upstream of the lower two dams, juvenile habitat below these dams is much less abundant than in other rivers. This lack of access to juvenile habitat is believed to be limiting recovery of the Menominee River sturgeon population. Reestablishing an effective migration route around the lower two dams is expected to increase production of young fish that should lead to a significant increase in abundance of adult sturgeon in the Menominee River population. Construction of an upstream fish elevator and downstream fish bypass were completed in spring of 2015 and are now being used to seasonally pass adult sturgeon upstream and provide a route for all fish to pass downstream around the lower 2 dams on the Menominee River. A three year study to evaluate up and downstream movement and behavior of adult sturgeon passed upstream is ongoing that will fine tune ongoing passage operations intended to increase abundance of this important Lake Michigan sturgeon population.

Corresponding Author: Robert_Elliott@fws.gov
Oral or Poster: Oral

Presenter: Jason Fischer

Co-Authors:
Jason Fischer1,2, Jaquelyn Craig1, Edward Roseman1, Carson Prichard1, Jeremy Pritt1, Greg Kennedy1, David Bennion1, Bruce Manny1, Justin Chiotti3, and James Boase3

1United States Geological Survey, Great Lakes Science Center, 1451 Green Road, Ann Arbor, MI 48105.
2Cooperative Ecosystems Studies Unit, Department of Fisheries and Wildlife, Michigan State University, East Lansing, MI, USA
3United States Fish and Wildlife Service, Alpena Fish and Wildlife Conservation Office, Waterford Substation, 7806 Gale Road, Waterford, MI 48327

Title: Reflections on a decade of lake sturgeon spawning habitat restoration in the St. Clair-Detroit River System

Abstract: Lake sturgeon (Acipenser fulvescens) were historically abundant throughout the St. Clair-Detroit River System (SCDRS). However, populations declined precipitously in the early 1900s following overharvest and construction of shipping channels which removed large amounts of cobble spawning substrates from the system. Regulations have since been established to protect adults from harvest, but loss of spawning substrates continues to limit lake sturgeon reproduction and recruitment. To increase spawning substrates available to lake sturgeon, artificial spawning reefs have been constructed throughout the SCDRS. To date, five reefs (about 3.2 Ha) have been constructed – three in the St. Clair River and two in the Detroit River. Since 2004, egg deposition has been monitored with egg mats to evaluate the use of these reefs and adjacent natural substrates by lake sturgeon and other lithophilic spawning fishes. Lake sturgeon eggs were rarely observed in the SCDRS prior to the construction of the Fighting Island reef in 2008, where eggs were collected for the first time the following spring. To date, lake sturgeon eggs have been observed in 5 of the last 7 years at this reef. Three subsequent reef projects have shown a similar positive response; lake sturgeon eggs were observed where they had not been collected during pre-construction assessments. Initial assessments indicate artificial spawning reefs provide lake sturgeon with new spawning opportunities in the SDCRS and mitigate losses of spawning substrates. However, continued assessment is needed to evaluate how these reefs mature and how reef maturation influences use by lake sturgeon and other fishes.

Corresponding Author: jfischer@usgs.gov
Oral or Poster: Oral

Presenter: Gillespie, Mark

Co-Authors:
M.A. Gillespie¹, P.A. Nelson¹, C.A. McDougall¹, J.L. Larter¹, P.M. Cooley¹, T. Sutton¹, D.S. MacDonell¹

¹North/South Consultants Inc., 83 Scurfield Blvd., Winnipeg, Manitoba

Title: Lake sturgeon spawning below a hydroelectric generating station: Egg deposition patterns and the refinement of a habitat suitability index model

Abstract: Fine-scale spawning site selection by Lake Sturgeon resident in large river systems is poorly understood. Each spring from 2007 to 2013, hundreds of egg mats were deployed immediately downstream of Pointe du Bois Generating Station (GS) yielding the capture of > 5000 of eggs/year. In general, egg capture rates were highest in close proximity to turbine discharges or spillway outflows, which varied (by year) from small trickles to intense torrents. Patterns of diminishing returns with distance indicated that Lake Sturgeon tended to move upstream to the base of physical or energetic barriers (powerhouse infrastructure or spillway rapids) prior to releasing their eggs, after which some downstream drift occurred. Substrate in the areas where deposition occurred consisted mainly of bedrock and/or coarse aggregates (boulder/cobble). A standard three variable (flow, depth, substrate) Habitat Suitability Index model grossly overestimated the quantity of spawning habitat used, but incorporation of “distance from physical or energetic barrier” and “flow direction” variables improved the model.

Corresponding Author: mgillespie@nscons.ca
Oral or Poster: Oral

Presenter: Haxton, Tim

Co-Authors:
Tim Haxton¹, Tim Cano¹

¹Ontario Ministry of Natural Resources and Forestry

Title: A global perspective of fragmentation on a declining taxon, sturgeon

Abstract: Globally, Acipenseriformes (sturgeon and paddlefish) are considered the most imperiled taxon with 25 of the 27 species on IUCN’s Redlist. Overexploitation through uncontrolled or illegal harvests caused the initial decline of sturgeon. Concurrently or shortly afterwards, dam construction occurred on many sturgeon rivers for either mechanical or hydroelectric power, or to facilitate log drives, all of which blocked access to or altered sturgeon spawning habitat. In addition, dramatic reductions in water quality due to use of rivers for industrial or municipal effluent and gross land abuses were also prevalent. For the most part, harvest levels are now controlled and water quality has improved through more stringent regulations. Hydro-electric dams however, are a long-term fixture on the landscape and have recently undergone a renaissance, further fragmenting sturgeon habitat and populations. The presence of hydro-electric facilities can play a significant role in limiting recruitment and therefore recovery of sturgeon populations across the landscape. River fragmentation has been extensive, in excess of 45,000 large dams (i.e., >15 m height) globally. The degree of fragmentation and water flow regulation was categorized globally on a watershed basis for large river systems by Dynesius and Nilsson (1994) as either strongly affected, moderately affected or unaffected. The objective of this study was to spatially identify areas globally where sturgeon populations were not considered at risk and rivers not extensively fragmented. Future pressures on these areas are identified, highlighting the need to incorporate sturgeon needs into development plans.

Corresponding Author: tim.haxton@ontario.ca
Oral or Poster: Oral

Presenter: Heinrich, Tom

Co-Authors:
Tom Heinrich\textsuperscript{1}, Mike Friday\textsuperscript{2}

\textsuperscript{1}Minnesota Department of Natural Resources, Baudette Area Fisheries Office
\textsuperscript{2}Ontario Ministry of Natural Resources, Quetico-Mille Lacs Fisheries Assessment Unit

Title: A population estimate for lake sturgeon in the Lake of the Woods – Rainy River System, 2014

Abstract: Lake Sturgeon \textit{Acipenser fulvescens} in the Lake of the Woods-Rainy River system have been recovering from over-exploitation, and the effects of environmental degradation, since the mid- to late-1960s. Population estimates made in 1989 and 2004 documented increasing abundance of Lake Sturgeon longer than 999 mm. After the 2004 population estimate a Lake Sturgeon management plan was produced, which recommended conducting population estimates on a 10-year frequency to monitor recovery of this population. In 2014, the Chapman modification of the Petersen estimator was used to estimate the number of Lake Sturgeon longer than 999 mm. The 2014 study design was based on the design used in 2004 allowing for direct comparison of abundance and size structure between time periods. The 2014 estimate documented the continued increase in the abundance of Lake Sturgeon. Since 1989 the population of Lake Sturgeon (>999 mm) has grown steadily from 16,910 fish (1989) to 59,050 fish (2004) to the current population of 92,286 fish (2014). Additionally, a greater proportion of “large” Lake Sturgeon was sampled in 2014 than in 2004, further suggesting continuing recovery of the population.

Corresponding Author: tom.heinrich@state.mn.us
Oral or Poster: Oral

Presenter: Heironimus, Laura

Co-Authors:
Laura B. Heironimus¹, Zachary Jackson¹

¹U.S. Fish and Wildlife Service, 850 S. Guild Avenue, Suite 105, Lodi, California 95240, USA

Title: Adult white sturgeon telemetry in the San Joaquin River, California

Abstract: The Central Valley Project Improvement Act required development of a program, the Anadromous Fish Restoration Program (AFRP), to “make all reasonable efforts” to ensure sustainable populations of six anadromous species “at levels not less than twice the average levels attained during the period of 1967–1991”. AFRP was further required to give priority to implementing measures that protect and restore channel and riparian habitat. Since 2012, AFRP has monitored White Sturgeon Acipenser transmontanus to understand relationships between environmental conditions and recruitment within the San Joaquin River basin in an effort to inform habitat restoration and water management decisions. From 2012 to 2015, 61 adult White Sturgeon were implanted with 69-kHz acoustic transmitters. The San Joaquin River basin houses a 23 receiver array used to detect acoustic transmitters and aid in understanding behavioral movement, such as: return rate, post-tagging effects, and environmentally driven migratory patterns. Return rate is important to understand variation in spawning periodicity. In 2013, 50% of previously tagged adults returned to the San Joaquin River (n=10; mean FL=126.40±9.63cm), 21% of tagged adults returned in 2014 (n=28; mean FL=132.47±8.35cm) and 37% of tagged adults returned in 2015 (n=43; mean FL=132.46±5.14cm). Further investigations into post-tagging behavior and the effects of environmental (e.g., temperature, change in temperature, discharge, change in discharge), morphometric (e.g., sex, fork length), and temporal variables (e.g., week, month, proximity to tagging event) on migratory cues and reproductive success are important for informing habitat restoration, harvest and water management decisions, and management planning.

Corresponding Author: Laura_Heironimus@fws.gov
oral or poster: oral

presenter: higgs, amanda

co-authors:
amanda higgs

1nysdec

Title: Habitat preferences of Hudson River Atlantic sturgeon

abstract: Little is known on detailed habitat use for Atlantic sturgeon in the Hudson River Estuary. Atlantic sturgeon were the most important commercial fish species in NY at the turn of the 20th century. Very high catches in the late 1880s collapsed the stock and fishing remained low until the 1980s and 1990s when an upsurge in harvest began. NY State closed the fishery in 1996 due to excessive harvest and efforts turned toward stock recovery. We sonic tagged both adults and juveniles to identify important areas used seasonally for essential activities: spawning, nursery and over-wintering. The technology used allows for pinpoint locations of fish. Locations are then compared to detailed benthic map recently completed for the Hudson. Sturgeon use areas of particular bottom types and not those most commonly found. Once identified, these areas can be protected to assist species recovery.

Corresponding Author: amanda.higgs@dec.ny.gov
Oral or Poster: Oral

Presenter: Hildebrand, Larry

Co-Authors:
Larry R. Hildebrand¹, Sima Usvyatsov¹, Kathleen Jay², Marco Marello³, and James A. Crossman⁴

¹Golder Associates Ltd. 201 Columbia Ave., Castlegar BC
²Jay Environmental, 305 Hart Street, Nelson, BC
³Terraquatic Resource Management, 1890 Ridgewood Road, Nelson, BC
⁴BC Hydro, 601 18th St., Castlegar, BC.

Title: Describing fine-scale movements of white sturgeon downstream of hydro facilities on the upper Columbia River using a Vemco positioning system

Abstract: We provide an analysis of White Sturgeon (Acipenser transmontanus) movements near the Hugh L. Keenleyside Dam (HLK) and Arrow Lakes Hydro (ALH) facilities on the Columbia River, based on a VEMCO Positioning System (VPS) dataset collected from December 1, 2013 to November 15, 2014. Over the course of the study, 54 individual White Sturgeon were positioned by the VPS. The presence/absence, fidelity, and movement patterns of these fish were analysed in relation to month, season, and environmental parameters (day/light conditions, water temperature, HLK discharge, water elevation). Logistic regression was used to estimate the effect of mean daily temperature, mean daily discharge rate, and mean daily water elevation on fish fidelity. Spatial distribution of tag positions in the VPS area exhibited marked temporal differences. A seasonal comparison of habitat use indicated fish were more aggregated in the winter with greater dispersion in the spring and summer. Results from this study help inform interactions of White Sturgeon with hydro facilities on the Columbia River. Further, we discuss logistical challenges with collecting fine scale positioning data in a working river including how changes in receiver array size and position (due to logging activities) over the study period were accounted for in the data analysis.

Corresponding Author: Larry_Hildebrand@golder.com
Oral or Poster: Oral

Presenter: Holmquist, Luke

Authors:
Luke M. Holmquist1, Molly A.H. Webb2, Christopher S. Guy3

1Montana State University, Department of Ecology, Bozeman, Montana 59717, USA.
2U.S. Fish and Wildlife Service, Bozeman Fish Technology Center, 4050 Bridger Canyon Road, Bozeman, Montana 59715, USA.
3USGS, Montana Cooperative Fishery Research Unit, Department of Ecology, Fish and Wildlife Ecology and Management Program, Montana State University, Bozeman, Montana 59717, USA.

Title: Do reproductively active hatchery-reared and released pallid sturgeon behave like reproductively active wild pallid sturgeon?

Abstract: Hatchery-reared pallid sturgeon (Scaphirhynchus albus) have been stocked in the upper Missouri River since the late 1990s in response to a lack of natural recruitment. The 1997 year-class (97-YC) of hatchery-reared fish are currently reaching sexual maturity, and we were interested in determining if spawning behavior of hatchery-reared fish is similar to wild fish. Our hypothesis was that movement and habitat use by reproductively active (RA) hatchery-reared fish would be more similar to the reproductively active wild fish than to other hatchery fish (from the same age-class) that were not reproductive. Mean total movement distances (± SE) during the presumed spawning season were greater for both RA males (97-YC and wild) than for immature 97-YC. Mean total movement distances were 86.18 (17.21) for RA wild males, 101.5 (36.1) for RA 97-YC males, and 16.1 (2.5) km for immature 97-YC males. Similarly, mean maximum net movement rates during the presumed spawning season were greater for both RA males (97-YC and wild) than for immature 97-YC. Mean maximum net movement rates were 5.82 km/d (2.2) for RA wild males, 7.9 km/d (4.7) for RA 97-YC males, and 0.9 km/d (0.2) for immature 97-YC males. Fish in all reproductive categories most often used main channel habitat and reaches without islands. These preliminary results indicate that reproductively active pallid sturgeon from a hatchery origin behave similarly to wild pallid sturgeon in this reach of the Missouri River.

Corresponding Author: luke.holmquist@gmail.com
Oral or Poster: Oral

Presenter: Jackson, Zachary

Co-Authors:
Zachary J. Jackson¹, Scott M. Blankenship², Gregg Schumer²

¹U.S. Fish and Wildlife Service, 850 S. Guild Avenue, Suite 105, Lodi, California, 95240, USA,
²Cramer Fish Sciences

Title: Estimating number of white sturgeon adults from egg relatedness

Abstract: The goal for using genetic information derived from egg samples is to gain insight into the reproductive biology of adult White Sturgeon *Acipenser transmontanus*. While field collection of eggs is a common activity, genetic material contained within eggs is rarely (if ever) analyzed. This project optimized laboratory protocols and analytical methods for White Sturgeon eggs in three phases. We determined the relationship between egg development stages and laboratory methods on the production of quality DNA and that subsequent genotype data could be used to infer number of spawners. Finally, we tested whether relatedness calculated from 65 eggs collected from the San Joaquin River, California during 2012 could be used to accurately estimate the minimum number of contributing parents. Wild caught eggs were likely part of at least six separate spawning events based upon capture location, date of capture, water temperature, stage of development, and the estimation that it takes a female up to 21 hours to release all of her eggs. We used various analytical techniques (e.g., PCA, DACP, Colony) to provide a more robust estimate of the number of matings and breeder abundance. While some siblings were observed, most eggs appeared to be unrelated. Analyses used standard protocols and published methods to estimate a range of 12–52 parents. Refining the estimation of clusters based on relatedness would likely occur if siblings were captured at a greater frequency. Accurate estimates of annual spawning population size are important for informing habitat restoration, harvest and water management decisions, and recovery planning.

Corresponding Author: Zachary_Jackson@fws.gov
Oral or Poster: Oral

Presenter: Jay, Kathleen

Co-Authors:
Kathleen J. Jay¹, James A. Crossman², and Kim T. Scribner³

¹ Jay Environmental, 305 Hart St., Nelson, British Columbia V1L 5N4, Canada
² BC Hydro, Environmental Risk Management, 601 18th Street, Castlegar, British Columbia V1N 2N1, Canada
³ Department of Fisheries and Wildlife, Michigan State University, 480 Wilson Road, 13 Natural Resources Building, East Lansing, Michigan 48824, USA

Title: Effects of temperature on yolk-sac larval development in white sturgeon

Abstract: Experiments were conducted to measure thermal induced responses in development of White Sturgeon Acipenser transmonanus yolk-sac larvae (YSL) reared at 12.5, 14.0, 15.5, and 17.0°C. We quantified temperature effects on time of initial occurrence (hours post hatch, hph; accumulative thermal units, ATU) of ten developmental stages from hatch to exogenous feeding. Concurrently, seven larval morphological traits (total length, TL; total body area, TBA; yolk-sac area, YSA; head area, HA; gill filament area, GFA; mouth area, MA; and pectoral fin area, PFA) were measured daily for fish reared at 12.5 and 17.0°C to compare endogenous resource allocation. Time of development significantly increased at temperatures of 15.5 and 17.0°C compared to 14.0 and 12.5°C with no significant difference between 15.5 and 17.0°C as a function of ATU, or 14.0 and 12.5°C for both ATU and hph. Development was not significantly different among rearing temperatures in terms of relative timing of development (RTi). At hatch, YSL reared in 12.5°C were larger, but not significantly, across all morphological traits. As a function of time, TL, TBA, HA, GFA, MA, and PFA were significantly larger, and YSA was significantly smaller in 17.0°C reared YSL after 2 days post hatch. However, results were inversed as a function of developmental stage with significantly larger TL, TBA, HA, GFA, MA, and PFA, and smaller YSA (no significance) in 12.0°C reared YSL after developmental stage 38. Describing thermal induced responses in the development of White Sturgeon YSL is important to understanding recruitment processes and natural adaptability in altered systems, and can be used as a management tool to increase understanding of White Sturgeon reproductive ecology.

Corresponding Author: katy.j.jay@gmail.com
Oral or Poster: Oral

Presenter: Kahn, Jason

Co-Authors:
J.E. Kahn¹, T. King², C. Hager³, J.C. Watterson⁴, and K. Hartman⁵.

¹National Marine Fisheries Service, 1315 East West Highway
Silver Spring, Maryland 20910
²U. S. Geological Survey, Leetown Science Center, 11649 Leetown Road
Kearneysville, West Virginia 25430
³Chesapeake Scientific, 100 Six Pence Court, Williamsburg, Virginia 23185
⁴U.S. Department of the Navy, Naval Facilities Engineering Command, Atlantic
6506 Hampton Boulevard, Norfolk, Virginia 23508
⁵West Virginia University, Division of Forestry and Natural Resources, 322 Percival Hall
Morgantown, West Virginia  26506

Title: A genetic analysis of the Pamunkey River, Virginia Atlantic sturgeon
(*Acipenser oxyrinchus*) spawning population

Abstract: On February 6, 2012, the National Marine Fisheries Service listed five distinct
population segments of Atlantic sturgeon as threatened and endangered under the
Endangered Species Act relying on the discreteness and significance of the genotypes of
12 spawning populations. When listed, the only known spawning population in the
Chesapeake Bay was in the James River, but the discovery of a spawning population in
the Pamunkey River, a tributary to the York River, allowed us to conduct a genetic
analysis of these new individuals compared with other populations along the East Coast.
The York River population displays homing fidelity to its natal river of over 90% but if it
is assumed these sturgeon are from one of the original 12 described populations, their
fidelity to the Chesapeake Bay DPS is 6.9%. A STRUCTURE analysis suggests this
population is significantly differentiated from any other known sturgeon populations.
Because this population’s genotype is significantly different from other known
populations in the Chesapeake Bay DPS, it is important for managers to know this
population is small, genetically isolated, and at risk of extirpation in order to
appropriately protect these individuals.

Corresponding Author: [Jason.Kahn@noaa.gov](mailto:Jason.Kahn@noaa.gov)
Oral or Poster: Oral

Presenter: Kahn, Jason

Co-Authors:
J.E. Kahn¹, C. Hager², J.C. Watterson³, and K. Hartman⁴.

¹National Marine Fisheries Service, 1315 East West Highway
Silver Spring, Maryland 20910
²Chesapeake Scientific, 100 Six Pence Court, Williamsburg, Virginia 23185
³U.S. Department of the Navy, Naval Facilities Engineering Command, Atlantic
6506 Hampton Boulevard, Norfolk, Virginia 23508
⁴West Virginia University, Division of Forestry and Natural Resources, 322 Percival Hall
Morgantown, West Virginia 26506

Title: Discovery of a new spawning population of Atlantic sturgeon (Acipenser oxyrinchus) in the Pamunkey River, Virginia with an estimate of the annual spawning run size

Abstract: The National Marine Fisheries Service listed five distinct population segments of Atlantic sturgeon as threatened and endangered under the Endangered Species Act on February 6, 2012. At the time of listing, the only population estimates were in the Altamaha and Hudson Rivers and the only known spawning population of sturgeon in the Chesapeake Bay was in the James River. Because so little was known about the Chesapeake Bay, we sampled the Pamunkey River, a tributary to the York River during the fall of 2013, to determine whether Atlantic sturgeon were upstream in spawning areas and if so, how many there were. A spawning population was confirmed when we captured numerous adult male Atlantic sturgeon running milt and one spawned out female with a few eggs still present. We used a Schumacher-Eschmeyer formula for multiple census to determine the size of the within year spawning populations in 2013, 2014, and 2015. We then used a Cormack-Jolly-Seber model to estimate the total abundance of sturgeon during this time. This study represents the first total adult population estimate of Atlantic sturgeon in any river along the coast.

Corresponding Author: Jason.Kahn@noaa.gov
Title: Comparison of lake sturgeon growth rates estimated from fin rays and mark-recapture

Abstract: Pectoral fin rays are commonly used as a non-lethal method for estimating age of lake sturgeon *Acipenser fulvescens*. While fin rays generally underestimate age of older lake sturgeon, fin rays could provide useful estimates of growth rate for younger fish within a population. Our objective was to determine if lake sturgeon growth rates estimated from fin rays were similar to growth rates observed from recaptures of lake sturgeon tagged with passive integrated transponders (PITs). Lake sturgeon were sampled in 2012-2013 via electrofishing on the Menominee River, where the Wisconsin and Michigan Departments of Natural Resources maintain a long-term PIT tagging program. Parameters from a von Bertalanffy growth model were used to describe growth rates estimated from fin rays (range of fin ray ages = 4 to 34). For recaptured fish, growth rates were quantified as change in length during time at large. Preliminary results suggest growth rates estimated from fin rays (mean = 1.18 in/yr) are substantially higher than rates observed from PIT tag recoveries (mean = 0.47 in/yr). This difference is consistent with underestimating lake sturgeon age from fin rays. Differences in growth rates between the two methods were inversely related to lake sturgeon total length, suggesting that fin ray growth estimates were more reliable for larger (≥ 50 in), older lake sturgeon, only because these fish were growing very slowly. Fin rays are probably not useful for estimating growth rates of lake sturgeon and we suggest that continued use of mark-recapture with PITs offers the best method for describing growth and survival in most lake sturgeon populations.

**Corresponding Author:** jkerns@uwsp.edu
Oral or Poster: Oral

Presenter: Kieffer, Micah

Co-Authors:
Alexander Haro¹, Theodore Castro-Santos¹, John Noreika¹, Micah Kieffer¹

¹Conte Anadromous Fish Research Laboratory, Leetown Science Center; 1 Migratory Way, Turners Falls, Massachusetts 01376

Title: Effect of upstream fish passage structure entrance design and head differential on attraction and entry of adult shortnose sturgeon

Abstract: Physical and hydraulic characteristics of upstream fish passage structures (e.g., fishways, fish lifts) are critical for effective attraction and entry of target migrant species. These characteristics may be species specific, but have not been extensively quantified. We evaluated attraction and entry of adult, wild shortnose sturgeon to experimental surface and submerged orifice entrance structures at several entrance head differential (water velocity) and siting (center of channel, side of channel) conditions, under controlled laboratory conditions. Attraction rates of sturgeon to entrances were low compared to previously tested species (i.e., American shad). Experiments were run for 24 hours periods; sturgeon were attracted to and entered both surface and submerged orifice entrances during both day and night. Initial attraction to both entrance choices was rapid, and passage rates through weirs and orifices were roughly equal. There was significantly higher passage at lower vertical heights, and most fish passed within 12-18 h. Results show a degree of interplay between attraction and passage for various entrance configurations and hydraulic conditions. For shortnose sturgeon, as for other species, particular combinations of factors may elicit significant attraction, but only modest passage, an understanding critical for determining effectiveness of existing passage structures or for designing new structures.

Corresponding Author: mkieffer@usgs.gov
Oral or Poster: Oral

Presenter: King, Tim

Authors:
Tim King¹, David Kazyak¹, Mike Eackles¹, Robin Johnson¹, Jason Kahn², and Michael Rasser³

¹US Geological Survey, Leetown Science Center, Kearneysville, WV
²National Oceanic and Atmospheric Administration, Silver Springs, MD
³Bureau of Ocean Energy Management, Sterling, VA

Title: Transitioning Atlantic sturgeon from population genetics to population genomics

Abstract: USGS-Leetown Science Center (LSC) in conjunction with NOAA-Fisheries has genotyped in excess of 800 Atlantic Sturgeon sampled from the St. Lawrence River, Canada to southern Georgia at 12 microsatellite DNA markers. This information has assisted resource managers by clarifying population structuring, identifying appropriate management units, and allowing assignment of individuals intercepted as bycatch or other anthropogenic activities to river or DPS of origin. As three putative metapopulations have been identified, fine-scale population resolution is required as well as the identification of adaptive features. To address this research need we have begun a transition from population genetics (12 microsatellite markers screened across 124 chromosomes) to population genomics (screen thousands of markers across the genome) by employing genotype by sequence (GBS). This research has allowed the identification and contrasting large numbers of neutral and non-neutral markers among collections interspersed across the species range to further assess functional (meta)population assemblages, identification of evolutionary significant lineages, and provided data for modeling adaptive resiliency. In addition, LSC has generated approximately 40X coverage of the Atlantic Sturgeon transcriptome in the form of 394,482 contigs (genome segments) using contemporary genomic sequencing (RNA-Seq). Variant detection in these contigs have yielded in excess of 1 million SNPs. We are currently in the process of annotating the transcriptome; the most complete of any Acipenseridae species. This transcriptome will provide an important resource for future studies of physiological and immunological processes in this species, and help delineate adaptive differentiation which ultimately could promote resiliency in the context of environmental change.

Corresponding Author: tlking@usgs.gov
Oral or Poster: Oral

Presenter: Koenigs, Ryan

Co-Authors:
Ryan P. Koenigs\textsuperscript{1*}; Ronald M. Bruch\textsuperscript{1}; Joanne Phipps\textsuperscript{2}; Paul Heisey\textsuperscript{2}; Chris Avalos\textsuperscript{2}

\textsuperscript{1} Wisconsin Department of Natural Resources; Bureau of Fisheries Management; Oshkosh, WI
\textsuperscript{2} Normandeau Associates; Drigmore, PA

Title: Entrainment survival of fingerling and yearling sized lake sturgeon passing the Shawano Paper Mill Station, Wolf River, Wisconsin

Abstract: Successful downstream passage of emigrating fish at hydro dams is necessary to sustain, increase, or restore both anadromous and resident sturgeon stocks. Mortality associated with passage through hydro turbines has been a major concern. Our objective was to provide direct estimates of injury and survival for fall fingerling (N=200; average 199 mm) and summer yearling (N=200; average 260 mm) sized lake sturgeon entrained through the Shawano Paper Mill Dam located on the Wolf River in Wisconsin. Entrainment survival was evaluated using the HI-Z tag recapturing technique with treatment fish released near the mid area of the turbine (42-74” diameter; Leffel style; 18 buckets; 100 rpm; head 11 ft; 90% efficiency; 260 cfs) and control fish released downstream of the turbine discharge. We recovered 88.7% of the fingerling and 90.6% of the yearling treatment fish. All recaptured fish were alive and only one yearling died during the 48h holding period. Tags only (assigned dead) were recaptured from 7.3% of fingerling and 8.8% of yearling sized treatment fish. Survival estimates were 92.7% ± 3.5% for fingerlings and 90.6% ± 3.8% for yearlings. Based on the recapture of only a single injured fish and the absence of injuries to recaptured fish missing HI-Z tags, the mortality rates presented here are likely conservative and underestimate survival. Our results indicate that the Shawano Station would have little impact on fall fingerling and summer yearling sized (< 300 mm) lake sturgeon entrained through the turbines.

Corresponding Author: Ryan.koenigs@wisconsin.gov
Oral or Poster: Oral

Presenter: Koenigs, Ryan

Co-Authors:

Ryan P. Koenigs*, Ronald M. Bruch†, Don Reiter‡, Jeremy Pyatskowit§

1Wisconsin Department of Natural Resources, Bureau of Fisheries Management, 625 E. County Rd Y, Oshkosh, WI 54901, 2Retired from Wisconsin Department of Natural Resources, Bureau of Fisheries Management 3Menominee Indian Tribe of Wisconsin, Menominee Conservation Fish and Wildlife Department, PO Box 910, Keshena, Wisconsin 54135,

Title: Lake Sturgeon Reintroduction and Movement in the Upper Wolf River

Abstract: The Winnebago System, Wisconsin, is home to one of the largest populations of lake sturgeon Acipenser fulvescens in North America. Lake sturgeon have access to more than 50 spawning sites within the Winnebago System, but two dams (Shawano Paper Mill furthest downstream and Balsam Row Dams furthest upstream) currently block upstream migration of sturgeon to the ancestral spawning location of Keshena Falls within the Menominee Reservation. The Wisconsin DNR and the tribe have joined efforts in a 10-year MOU to restore lake sturgeon spawning to Keshena Falls while also establishing a river resident population upstream of the dams. Under the guidance of the MOU, 100 or more lake sturgeon per year are captured below the downstream dam and transferred upstream of the Balsam Row Dam. Three distinct sampling periods are targeted (early fall, late fall, spring pre-spawn). To date, 483 lake sturgeon have been transferred, of which 245 were marked with acoustic transmitters. Spring transferred fish had a higher tendency to spawn above the Balsam Row Dam (females 70.2%; males 79.9%) than late fall transferred fish (females 41.8%; males 41.2%). Retention of sturgeon upstream of both dams was very low with the majority of the fish migrating downstream within the first 2 years following release (early fall 86.4%, late fall 96.6%, spring 93.1%). Study results indicate that capture and transfer operations can restore lake sturgeon spawning activity upstream of barriers and should be considered as an alternative to mitigate the impact of barriers to upstream movement.

Corresponding Author: Ryan.koenigs@wisconsin.gov
Oral or Poster: Oral

Presenter: Love, Seth

Co-Authors:
Seth A. Love\textsuperscript{1*}, Quinton E. Phelps\textsuperscript{2}, Sara J. Tripp\textsuperscript{2}, and David P. Herzog\textsuperscript{2}

\textsuperscript{1}Southeast Missouri State University
\textsuperscript{2}Missouri Department of Conservation

Title: Shovelnose and pallid sturgeon environmental life history in the Missouri and Middle Mississippi Rivers

Abstract: Population declines of \textit{Scaphirhynchus} sturgeon have resulted in increased efforts to understand their environmental life history. These efforts have revealed that, like many large river fishes, \textit{Scaphirhynchus} sturgeon exhibit extensive movement patterns within the Lower Missouri and Middle Mississippi Rivers. Even so, the importance of these rivers at various life stages (particularly those where origin and recruitment occur) have not been fully evaluated. The objective of this study was to determine movement patterns and natal origin of Lower Missouri and Middle Mississippi River \textit{Scaphirhynchus} sturgeon. Fin rays from individuals collected from these two systems were analyzed using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS), and were compared to Missouri and Mississippi River water chemistry samples. The results of this study revealed that, while a small percentage of the sturgeon remained in either the Missouri or Mississippi River (i.e., did not leave natal system), a larger proportion traversed between the two systems. This intersystem movement could allow for recruitment contribution from each river (e.g., Middle Mississippi River contributing to the Lower Missouri River). This information garnishes valuable information into the life history and migration patterns of Missouri River and MMR \textit{Scaphirhynchus} sturgeon, which suggests interjurisdictional management is needed to conserve these species.

Corresponding Author: seth.love12@houghton.edu
Presenter: Markin, Erin

Co-Authors:
Erin Markin\textsuperscript{1*}; David Secor\textsuperscript{2}

\textsuperscript{1} University of Maryland Center for Environmental Science Horn Point Laboratory
2020 Horns Point Road, Cambridge, MD 21613
\textsuperscript{2} University of Maryland Center for Environmental Science Chesapeake Biological Laboratory, PO Box 38, Solomons, MD 20688

Title: Bioenergetics models of habitat suitability and fall versus spring spawning by Atlantic sturgeon in the Chesapeake Bay

Abstract: Bioenergetics models developed by Niklitschek (2001) for Atlantic sturgeon (\textit{Acipenser oxyrinchus}) suggest a complex interaction between temperature, salinity, and dissolved oxygen in limiting habitat for Atlantic sturgeon within the Chesapeake Bay. During their first summer of life, sturgeon may experience a three-way habitat squeeze – salinity, hypoxia, and temperature - significantly limiting suitable. Despite the predictions of reduced habitat suitability over most years in the Chesapeake Bay, occurrence of sub-adults and adults in the Chesapeake Bay are frequent. Water quality data (1990-2013) was compiled and spatially interpolated from the Chesapeake Bay Program Water Quality Database to estimate seasonal potential juvenile sturgeon production in the using the bioenergetics model developed by Niklitschek. This measure of habitat quality was assessed against recent records of incidence of Atlantic sturgeon. During Winter, Spring, and Fall, increased incidences occurred in regions of high habitat suitability as estimated by the bioenergetics model. In Summer, sturgeon sometimes occurred in regions predicted to have poorer than average habitat suitability. Additionally, we modelled the net gain in biomass gain for cohorts of individuals that were spawned in either the Spring or Fall. On average, sturgeon spawned in the Spring had more net gain in biomass than those spawned in the Fall. Results indicate that Atlantic sturgeon may be better adapted to changed water quality conditions in the Chesapeake Bay than previously thought.

Corresponding Author: eryder@umces.edu
Presenter: McDougall, Craig

Co-Authors:
C.A. McDougall¹, P.A. Nelson¹, K. Kansas², D. Kroeker², D. Macdonald³, C.C. Barth¹, D.S. MacDonell¹

¹North/South Consultants Inc., Winnipeg, Manitoba
²Manitoba Fisheries Branch, Eastern Region, Lac du Bonnet, Manitoba
³Manitoba Fisheries Branch, Northwestern Region, Thompson, Manitoba

Title: Habitat quantity required to support self-sustaining lake sturgeon populations: An alternative hypothesis

Abstract: Citing the capacity of anadromous Acipenseridae sp. to undertake lengthy spawning migrations, Auer (1996) suggested a minimum of 250 - 300 km of barrier-free lake and river habitat were required to support self-sustaining Lake Sturgeon, Acipenser fulvescens, populations. Twenty years later, knowledge of this potamodromous species has improved considerably, and several examples of populations persisting/recruiting in impounded habitats have been documented in the literature. Furthermore, genetic analysis in the Winnipeg and Nelson rivers suggests the presence of multiple populations, likely attributable to historical confinement by falls/rapids. Herein, we used POPAN mark-recapture models to examine contemporary Lake Sturgeon abundance and population trajectory in sections of Manitoba rivers influenced by hydroelectric development. Following cessation of harvest approximately two decades prior, results indicate that population recovery is occurring in all three areas examined. We suggest that Lake Sturgeon populations can thrive (and probably have for 1000s of years) in lake/river/impoundment sections as small as 10 km, so long as spawn-drift-settle-establish habitat sequences occur uninterrupted.

Corresponding Author: cmcdougall@nscons.ca
Presenter: Meyer, Hilary

Co-Authors:
Hilary Meyer¹, Kristen Grohs², Dane Shuman², Mark Fincel¹

¹ South Dakota Department of Game, Fish and Parks, 20641 SD HWY 1806, Fort Pierre, SD 57532
² USFWS Great Plains Fish and Wildlife Conservation Office, 420 S Garfield Avenue Suite 400

Title: Movement of translocated paddlefish in Lake Sharpe, South Dakota

Abstract: After completion of Oahe Dam in 1956, a significant paddlefish (Polyodon spathula) sport fishery developed in the tailrace (modern day Lake Sharpe). Anglers harvested approximately 7,500 paddlefish from the tailrace between 1960-1962. After completion of Big Bend Dam in 1963, harvest of paddlefish declined, and the sport fishery was closed in 1964. South Dakota Department of Game, Fish and Parks (SDGFP) currently manages two paddlefish fisheries on the Missouri River through a limited draw lottery system. These fisheries are very popular, and receive up to five times the number applications as there are tags available. Biologists at SDGFP proposed to stock up to 15,000 advanced fingerlings in Lake Sharpe from 2016-2026 to assess the potential to develop a new sport fishery in central South Dakota. In 2015, SDGFP collaborated with the US Fish and Wildlife Service (USFWS) to translocate 20 adult paddlefish from Lake Francis Case, SD to Lake Sharpe. Our objectives are to describe post-stocking movement and survival of paddlefish in Lake Sharpe. Twenty adult paddlefish were implanted with acoustic telemetry tags and released in May 2015 at two locations in Lake Sharpe. Paddlefish were actively tracked by USFWS biologists using a boat mounted hydrophone. Initial results indicate that paddlefish congregate near the tailrace of Oahe Dam during summer months. Information about paddlefish movements within Lake Sharpe will help SDGFP biologists prioritize stocking locations, as well as provide insight into the potential for a future sport fishery.

Corresponding Author: Hilary.Meyer@state.sd.us
**Oral or Poster: Oral**

**Presenter:** Miller, Emily

**Co-Authors:**
Emily Miller\(^1\), Michael Thomas\(^2\), Gabriel Singer\(^2\), Matthew Peterson\(^3,4\), Eric Chapman\(^2\), Ryan Battleson\(^2\), Molly Webb\(^4\), Marty Gingras\(^5\), and A. Peter Klimley\(^2\)

\(^1\)Graduate Group in Ecology, University of California, Davis  
\(^2\)Wildlife, Fish, and Conservation Biology Department, University of California, Davis  
\(^3\)FishBio, Chico, CA  
\(^4\)Bozeman Fish Technology Center, Bozeman, MT  
\(^5\)California Department of Fish and Wildlife, Bay-Delta Region, Stockton, CA

**Title:** Green and white sturgeon migratory movements in the San Francisco Bay, Delta, and Sacramento River, California

**Abstract:** Green and white sturgeon, *Acipenser medirostris* and *A. transmontanus* respectively, are sympatric sister taxa found in the Sacramento-San Joaquin watershed that differ in their life history patterns. Understanding the distributional overlap of the two species while in the watershed can inform management decisions. The anadromous green sturgeon spends much of its subadult and adult life in nearshore marine waters along the northern Pacific coast while the semi-anadromous white sturgeon resides within the estuary throughout adulthood. However, subadult and adult green sturgeon are present in the estuary and delta during pre-spawning migrations in spring and post-spawning movements after holding upriver for the summer or through fall or winter. Juveniles reside in the lower river, delta and bay as they age and out-migrate. We acoustically tagged 160 white and 41 green sturgeon from 2010-2012 in San Francisco Bay. Tagged sturgeon included large juveniles, subadults, and adults. Green sturgeon adults previously tagged by our laboratory were also included in analyses. The array of monitors operated by our Laboratory, state, federal, and consulting agencies detected individual sturgeon movements from 2010-2014. Size-class distributions of each species and the timing of movements of spawning adults by watershed reach will be compared. Route selection through the delta by migratory adults will be compared pre- and post-spawn. Understanding how green and white sturgeon differ in their timing of seasonal movements and movement paths within the watershed can improve the management of each and help explain the mechanisms of coexistence of these two closely related species.

**Corresponding Author:** [eamiller@ucdavis.edu](mailto:eamiller@ucdavis.edu)
**Oral or Poster: Oral**

**Presenter:** Nelson, Patrick

**Co-Authors:**  
P.A. Nelson¹, C.A. McDougall¹, and C. C. Barth¹

¹ North/South Consultants Inc. 83 Scurfield Blvd., Winnipeg, Manitoba, R3Y 1G4

**Title:** Lake sturgeon population recovery modeling

**Abstract:** In 2006, the Committee on the Status of Endangered Wildlife in Canada report recommended the Lake Sturgeon, *Acipenser fulvescens*, be listed under Canada’s Species at Risk Act. Using population viability analysis, the Department of Fisheries and Oceans produced recovery potential assessments for all 8 Designatable Units (DUs). These models were initially constructed using literature values and best information; however, significant research in each of the 8 DUs has been conducted since these models were developed. Herein, we update parameter estimates based on the newly acquired information. Specifically, the survival rate was increased for both stocked and wild juveniles, and growth/condition relationships were modified to account for variation observed amongst populations. We present results of Lake Sturgeon recovery potential modeling using three length-at-age relationships (fast, moderate, slow growth), while taking into account variable recruitment, stocking, and entrainment.

**Corresponding Author:** pnelson@nscons.ca
Oral or Poster: Oral

Presenter: Pagel, Matthew

Co-Authors:
Matthew D. Pagel¹, Peter A. Klimley¹, Michael D. Thomas¹

¹ Department of Wildlife, Fish, and Conservation Biology, University of California, Davis, One Shields Avenue, Davis, California 95616

Title: Real-time monitoring of acoustically tagged fishes in the Sacramento-San Joaquin watershed

Abstract: We are currently augmenting a core array of stand-alone acoustic tag-detecting receivers with “real-time” capability within the Sacramento-San Joaquin watershed in California. These core array receivers, located at over 100 sites, provide valuable information used to assess movement patterns of anadromous fishes, including sturgeon. However, the current quarter-annual data-retrieval schedule of the stand-alone receivers does not lend itself to rapidly adaptive water-management schemes responsive to protected fish. To correct this shortcoming, real-time stations are being added. Each station is equipped with receivers for three acoustic tag technologies: 416.7 kHz phase-coded (JSATS) and 69 kHz & 180 kHz pulse-coded (VEMCO). These stations are being strategically placed at critical locations within the watershed in order to alert managers of the potential for fish stranding at weirs during high-flow events (e.g. rainstorms) and to reduce potential for fish entrainment near and within major man-made water diversions. One example of such diversions is the Delta Cross Channel (DCC), which shunts Sacramento River water into pumping facilities for export to southern California and regional agriculture. Water management agencies are apprised in real-time of detections of tagged individuals of ESA-listed species and are guided by this information to close the gates of the DCC as fish approach during migration, limiting entrainment and thereby increasing the migratory success of anadromous fishes. A demonstration will be given of the web-based interface which permits resource managers to balance the protection of fishes with human water demands by sending immediate or daily email alerts of the detections of ESA-listed species.

Corresponding Author: mpagel@ucdavis.edu
**Oral or Poster: Oral**

**Presenter:** Palensky, Lynn

**Authors:**
Lynn Palensky

1Northwest Power and Conservation Council, Fish and Wildlife Division, 851 SW 6th Ave Suite 1100, Portland, OR 97204

**Title:** Columbia River white sturgeon: Critical uncertainties and emerging issues

**Abstract:** The Columbia River Basin (Basin) in the Pacific Northwest occupies an area of 673,396 km², and once supported a large and productive population of white sturgeon (*A. transmontanus*). Twenty-four major dams in the mainstem Columbia and Snake Rivers have fragmented this species into subpopulations whose productivity varies from marginally productive to functionally extirpated. This reduced productivity is also documented in the federally-endangered headwater population of Kootenai River white sturgeon, isolated for over 10,000 years by natural barriers. Sturgeon in the Columbia have taken a back seat to salmon for years in the “charismatic fish” category, but as emerging challenges and uncertainties mount for sturgeon, so has the attention and stature of sturgeon as an iconic species. Emerging issues for white sturgeon include pinniped predation, poaching for caviar, early closures for fisheries, and recent deaths likely due to extreme low water, low oxygen and warm temperatures in 2015. With increased attention and emerging challenges comes the need to better understand and manage the species. The Northwest Power and Conservation Council and a panel of independent scientists recently compiled a list of priority research questions – based on critical uncertainties – for sturgeon by geographic area in the Basin. The critical uncertainties were developed over time by federal and state fish and wildlife agencies and Native American Tribes in the Basin. This list will be used to guide sturgeon-related research in the Basin -- research that seeks to improve our understanding of sturgeon life histories, and management.

**Corresponding Author:** Lpalensky@nw council.org
Oral or Poster: Oral

Presenter: Parsley, Michael

Co-Authors:
Michael J. Parsley

Title: Salmon fishways in the Columbia River basin and their use by white sturgeon

Abstract: The Columbia River Basin is the most dammed river system in North America. Home to 5 species of anadromous Pacific salmon, some mainstem dams on the Columbia and Snake rivers were constructed with fishways to enable salmon to return upstream to natal spawning areas. Fish lifts constructed at Bonneville Dam in the 1940s were used to pass white sturgeon upstream but their use was discontinued in the 1950s because the lifts were ineffective for passing adult salmon. Daily passage of white sturgeon *Acipenser transmontanus* from 1998 through present are now available in digital format and I used the data to address specific questions regarding upstream passage by white sturgeon. Summaries of the timing of counts and estimated lengths of white sturgeon passing dams reveal interesting information. Mean lengths and peak of timing of white sturgeon counted suggests that current upstream passage is not related to a spawning migration. Differences in white sturgeon lengths and differences in timing of counts between fishways at individual dams suggest that physical or hydraulic conditions influencing approach, attraction, entry, and ultimately passage differ among sites. These findings suggest that further study could provide information on ways to improve upstream passage of white sturgeon and other species.

Corresponding Author: fishbios@gorge.net
**Oral or Poster: Oral**

**Presenter: Peterson, Douglas**

**Co-Authors:**
Douglas Peterson¹, Evan C. Ingram¹, Adam Fox¹

Warnell School of Forestry and Natural Resources, The University of Georgia, 180 East Green Street, Athens, GA 30602-2152, USA

**Title: Spawning behavior and habitat use of Atlantic sturgeon in the Altamaha River, Georgia**

**Abstract:** During the 20th Century, populations of Atlantic Sturgeon suffered range wide declines resulting from overfishing and chronic habitat loss. Although the species was listed under the U.S. Endangered Species Act in 2012, recovery has been hindered by a lack of basic ecological Information. Data on the timing and duration of spawning runs and habitat use remain as critical information gaps – particularly in the southern portion of the range where few directed studies of Atlantic Sturgeon have been attempted. The objectives of this study were to describe the spawning movements and habitat of Atlantic Sturgeon in the Altamaha River, Georgia. From 2011 through 2014, we used an acoustic array consisting of 148 stationary receivers deployed throughout 650 river kilometers to monitor the movements of 45 adult Atlantic Sturgeon in the Altamaha River System. Our results showed that although the adult fish used two distinctly different migration patterns, they reached the presumed spawning grounds in late fall. These results were surprising because historic data from commercial fisheries suggested that spawning occurred in spring. These findings illustrate a striking latitudinal variation in the specie’s ecology, further highlighting the need for management of distinct population segments with regionally specific recovery goals.

**Corresponding Author:** dpeterson@warnell.uga.edu
Oral or Poster: Oral

Presenter: Rayford, Sharon

Co-Authors:
Sharon V. Rayford¹, Zachary J. Jackson¹, Joshua J. Grube¹

¹ U.S. Fish and Wildlife Service, 850 S. Guild Avenue, Suite 105, Lodi, California 95240

Title: White sturgeon spawning in the San Joaquin River, California: Investigating the effects of managed streamflows

Abstract: The primary focus of this study was to determine if sturgeon (genus Acipenser) are spawning in the San Joaquin River in various water-year types by collecting fertilized sturgeon eggs with artificial substrate samplers. Anglers have reported capturing both White Sturgeon *Acipenser transmontanus* and Green Sturgeon *A. medirostris* in the San Joaquin River upstream from Stockton, California. In 2011 (wet year type) and 2012 (dry year type) we collected fertilized eggs within a 20-km reach downstream from Grayson, California. However, in 2013, 2014, and 2015 (critical year types) no eggs were detected within the study area, although it is possible that sturgeon spawned outside the area sampled or spawned in low numbers that were not detected by our methods. Spring rains and small magnitude, short-duration pulse flow augmentations intended to benefit juvenile salmonids appear to have triggered White Sturgeon spawning during 2012. Findings to date indicate that White Sturgeon spawn in the San Joaquin River in both wet and dry years, but not critical years. Therefore, the San Joaquin River system may be an important source of production for the White Sturgeon population in the San Francisco Estuary watershed during some years. Understanding the effects of water management on spawning and subsequent recruitment is necessary to manage for increased recruitment in any regulated system. Further, understanding the physical characteristics of the areas being used by sturgeon will help identify potential restoration actions.

Corresponding Author: Sharon_Rayford@fws.gov
Oral or Poster: Oral

Presenter: Rider, Steven

Co-Authors:
Steven J. Rider¹, Travis R. Powell¹, Thomas W. Ringenberg¹

¹ Alabama Department of Conservation and Natural Resources, Wildlife and Freshwater Fisheries Division, River and Stream Fisheries Program, 3608 Fairground Road, Montgomery, AL 36110

Title: Management of the recently-opened commercial paddlefish fishery in the Alabama River

Abstract: In the early 1980’s, increased commercial fishing pressure occurred on paddlefish (Polyodon spathula) populations in Alabama. This was due to commercial fishers directing their effort to Alabama after depleting the Tennessee River paddlefish populations in other southeastern states. This increased fishing effort resulted in a decline of paddlefish abundance and size in Alabama. As a result, the Alabama Division of Wildlife and Freshwater Fisheries placed a moratorium on the capture and possession of paddlefish in Alabama waters in 1988. Due to the increase in market prices and world-wide demand for caviar (circa 2002), the ALDWFF received numerous inquiries into the status of paddlefish in Alabama and the potential to open the fishery. After determining the paddlefish population was viable to sustain harvest and developing a Paddlefish Management Plan for the Alabama River (Mobile River Basin), a “provisional” fishery was opened in 2013. A total of 192, 590, and 1,191 gravid females were harvested in 2013, 2014, and 2015, respectively. Accordingly, 878 lbs. of eggs were processed in 2013, 2,235 lbs. in 2014 and 4,946 lbs. in 2015. Through the use of a “provisional” fishery, the Alabama Division of Wildlife and Freshwater Fisheries has been able to appropriately adjust regulations as needed in the first 3 years of commercial harvest. Results from these provisional seasons will serve as a framework for other paddlefish fisheries in Alabama.

Corresponding Author: steve.rider@dcnr.alabama.gov
Oral or Poster: Oral

Presenter: Sakamoto, Kathrine

Co-Authors:
Kathrine Sakamoto¹, William A. Dew², Stephen J. Hecnar¹, Gregory G. Pyle¹,³

¹Dept. of Biology, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario, P7B 5E1.
²University of Brandon, 270-18th Street, Brandon, Manitoba, R7A 6A9
³University of Lethbridge, 4401 University Drive, Lethbridge, Alberta, T1K 3M4.

Title: Lampricide impairs olfaction in young-of-the-year lake sturgeon (Acipenser fulvescens)

Abstract: Fish that feed or travel in low light conditions particularly rely on their chemical senses, such as olfaction, for survival. Exposure to toxicants at concentrations lower than those causing mortality can have detrimental effects on olfactory senses. This research studied effects of the lampricide 3-trifluoromethyl-4-nitrophenol (TFM) on the olfactory capabilities and behaviour of young-of-the-year (YOY) lake sturgeon (Acipenser fulvescens). The methods utilized included electro-olfactography, behavioural trials and activity analysis. Laboratory exposure of YOY lake sturgeon to TFM caused a reduced olfactory response to L-alanine, taurocholic acid and a food cue. It also reduced attraction to the scent of food and food consumption in the same species. Exposed fish were active for a higher percentage of time, but with slower acceleration. Fish were able to detect the scent of TFM, but did not significantly avoid it, which may expose them to the full toxic effects. This research raises concern that exposure of YOY sturgeon to TFM in tributaries of the Laurentian Great Lakes may impact their ability to normally function in their natural habitat for an undetermined amount of time.

Corresponding Author: ksakamot@lakeheadu.ca
Oral or Poster: Oral

Presenter: Scarneccia, Dennis

Co-Authors:
Dennis L. Scarnecchia, L. Fred Rychman, K. Michael Backes, Jason D. Schooley

Title: What have MT-ND-OK paddlefish fisheries and caviar programs taught us that may be useful for sturgeon management and recovery?

Abstract: Research, monitoring and stock assessment activities for paddlefish directed by state agency managers in Montana, North Dakota, and Oklahoma, in conjunction with non-profit roe donation (caviar) programs in the three states, have provided a greatly improved understanding of the species; this information may be applicable in some, or perhaps, most, instances, to other Acipensieriform species, although there has been limited beneficial usage of those findings to date outside of the three states. Information potentially of use includes: 1) the identification of distinct life history stages of the paddlefish in terms of maturation, GSI, gonadal fat accumulation and depletion, reproductive periodicity (recrudescence), and migration behavior, 2) the compression of these life history stages, and a shorter lifespan, based on metabolism and correlated with latitude and growing season, 3), the incidence, and potential prevalence, of episodic recruitment and its possible causes, and 4) how to specifically use 1-3 in developing sustainable harvest fisheries and management strategies for the species. Results from those programs may be useful in developing management programs for harvestable sturgeon populations, and for understanding what to expect with stocking programs and recovery efforts for threatened and endangered populations.

Corresponding Author: scar@uidaho.edu
Oral or Poster: Oral

Presenter: Schooley, Jason

Co-Authors:
Jason D. Schooley¹, Michael R. Schwemm², Anthony A. Echelle³, and James M. Long²

¹Paddlefish research center, Oklahoma Department of Wildlife Conservation, 61091 E 120 Rd Miami, Oklahoma 74354
²Department of Natural Resources Ecology and Management, Oklahoma State University, Stillwater, Oklahoma
³Department of Zoology, Oklahoma State University, Stillwater, Oklahoma

Title: Genetic analyses and demographic dynamics of paddlefish in Oklahoma

Abstract: Oklahoma represents the southwestern limit for paddlefish Polyodon spathula and includes robust, wild-recruited stocks in addition to repatriated stocks from hatchery origins. A voluntary roe-donation program established in 2008 provided funding for enhanced management, including the characterization of genetic structure and genetic management units (GMUs). Here, we described fine-scale geographic variation using microsatellite markers from seven Oklahoma stocks from the Red and Arkansas river basins plus two wild stocks from neighboring states. Additional analyses were performed to describe annual genetic variation across nine cohorts from Grand Lake, the state’s blue-ribbon fishery, to determine the impacts of extreme episodic recruitment in a stock dominated by a single cohort (1999). Results showed that Oklahoma paddlefish generally exhibit low to moderate levels of genetic variation within stocks, possibly resulting from recent bottlenecks and limited gene flow among reservoir stocks. Genetic distinctiveness among all stocks (global FST) was significant, but pairwise comparisons were variable, reflecting a combination of geographic isolation and stocking practices. Annual sampling of Grand Lake revealed uniform genetic variation across cohorts, and indicated that the spawning population comprised a sufficiently large, random sample. Despite the variability in the number of contributing breeders year to year, the overall genetic effective population size across generations has remained high; a situation likely buffered by high fecundity, iteroparous reproduction, long lifespan, and random mating. Additionally, differences in fish size were noted across GMUs, with larger fish found in reservoirs stocked from sources outside Oklahoma. Given the successful recruitment and genetic distinctiveness of Oklahoma paddlefish, especially the Grand River system, management actions will likely continue to both conserve the wild-recruiting stocks and maintain the differences across GMUs.

Corresponding Author: jason.schooley@odwc.ok.gov
**Oral or Poster: Oral**

**Presenter:** Schreier, Andrea

**Co-Authors:**
Andrea Schreier, Shawn Young, Joel Van Eenennaam, Anne Todgham, Molly Webb, Jeff Powell

**Title:** The skinny on spontaneous autopolyploidy in sturgeon conservation aquaculture

**Abstract:** White sturgeon conservation aquaculture programs inadvertently produce spontaneous autopolyploids. While all sturgeon are ancient polyploids, spontaneous autopolyploids inherit an additional genome copy from their mother and are therefore genetic triploids. Spontaneous autopolyploid (12N) white sturgeon are fertile and when crossed with normal 8N fish can produce viable offspring of intermediate ploidy (10N). We have conducted extensive ploidy screening a white sturgeon conservation aquaculture program and found ~10% of offspring produced have abnormal ploidy. The proportion of spontaneous autopolyploids is highly variable among families, ranging from 0-47% (mean 10%). Recent ploidy screenings in three additional white sturgeon hatchery programs have identified 12N offspring. Spontaneous autopolyploidy is likely not limited to white sturgeon, as its been detected by European researchers in a number of different sturgeon species. In fact, a spontaneous autopolyploid hatchery-reared pallid sturgeon was sampled during a USFWS monitoring program this year. Why is this happening? What is the scope of the problem? What are the implications for sturgeon conservation? The goal of my talk is to address these questions by presenting results from multiple ploidy screening programs, describing the potential causes of sturgeon spontaneous autopolyploidy, sharing preliminary data suggesting possible implications for conservation, and describing an ongoing study designed to better characterize the phenomenon.

**Corresponding Author:** amdrauch@ucdavis.edu
Oral or Poster: Oral

Presenter: Schulze, Joshua

Co-Authors:
Joshua C. Schulze1*, Daniel A. Isermann2, Michael Donofrio3, Steven Cooke4, Robert Elliott5, Edward Baker6, Keith Turnquist7

1 Wisconsin Cooperative Fishery Research Unit, University of Wisconsin-Stevens Point, 800 Reserve St., Stevens Point, WI 54481
2 U.S. Geological Survey, Wisconsin Cooperative Fishery Research Unit, University of Wisconsin-Stevens Point, 800 Reserve St., Stevens Point, WI 54481
3 Wisconsin Department of Natural Resources, Bureau of Fisheries Management, 101 N. Ogden Rd., Peshtigo, WI, 54157
4 Department of Biology, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, Canada, K1S 5B6
5 United States Fish and Wildlife Service, Green Bay Fish and Wildlife Conservation Office, 2661 Scott Tower Drive, New Franken, WI 54229
6 Michigan Department of Natural Resources, Marquette Fisheries Station, 488 Cherry Creek Road, Marquette, MI 49855
7 Molecular Conservation Genetics Laboratory, College of Natural Resources, University of Wisconsin-Stevens Point, 800 Reserve St., Stevens Point, WI 54481

Title: Lake sturgeon movements after passage upstream of two hydroelectric dams on the Menominee River, Wisconsin-Michigan

Abstract: Lake sturgeon Acipenser fulvescens populations in the Great Lakes have declined dramatically over the last two centuries and recovery is hindered by dams on tributaries, which prevent access to spawning and juvenile habitat. Fish passage operations could mitigate these negative effects, however potential efficacy of these operations is unknown. Facilities for passing lake sturgeon have been constructed on the Menominee River that borders Wisconsin and Michigan, providing the opportunity to assess sturgeon behavior following upstream passage. Our research objectives are to determine: 1) if adult lake sturgeon passed upstream return downstream to the lower Menominee River or Green Bay within 1 or 2 years of passage; 2) if adult lake sturgeon have the opportunity to spawn at least once above Park Mill Dam within 1-2 years after passage and 4) if spawning opportunity, downstream return rates, and use of the downstream fishway at Park Mill Dam are related to timing of passage, time elapsed after passage, month of year, flow or temperature conditions, or in relation to fish attributes such as sex, length, genetic stock, and maturation status. From October 2014 to May 2016, 120 mature lake sturgeon will be implanted with acoustic transmitters and released above the lowest two dams on the Menominee River. Movements are being monitored using fixed acoustic receivers and periodically with a portable receiver. Currently, 35 of the 120 lake sturgeon have been passed upstream and preliminary results indicate sturgeon behavior after passage is variable, although most of the fish have remained above both dams.

Corresponding Author: jschu194@uwsp.edu
Oral or Poster: Oral

Presenter: Schwinghamer, Christopher

Co-Authors: Christopher Schwinghamer¹, Sara Tripp², and Quinton Phelps¹,²

¹Southeast Missouri State University,
²Missouri Department of Conservation, Big Rivers and Wetlands Field Station, 3815 E Jackson Blvd, Jackson, MO 63755

Title: Paddlefish reproductive ecology in Harry S. Truman Reservoir, Missouri

Abstract: Creating reservoirs on large rivers drastically alters habitat utilized by the species that in habitat that large river. They transform lotic habitat into lentic habitat, flood historical spawning habitat and can block spawning migrations. This can put the species that use these habitats at risk. One such species is the Paddlefish *Polyodon spathula*, which are a popular sport fish in Missouri. Demand from recreational anglers has created a need to maintain stability in Paddlefish populations across Missouri. Sustainable populations in Missouri’s reservoirs have been maintained through annual stocking, as successful reproduction has never been documented in these systems. As such, our objectives are to locate spawning aggregations and collect eggs or larvae near these aggregations. To accomplish this, Paddlefish will be captured using gill nets and 100 reproductive adults will be implanted with ultrasonic transmitters. Tracking these individuals will allow us to track movement patterns and locate spawning aggregations. Eggs mats and trawls will then be employed to collect eggs or larvae. The results of this study will allow management officials to assess stocking protocols and help to ensure sustainable populations in reservoir ecosystems.

Corresponding Author: Chris.Schwinghamer@mdc.mo.gov
Oral or Poster: Oral

Presenter: Scribner, Kim

Co-Authors:
Iyob Tsehaye¹, Travis O. Brenden¹, James R. Bence¹, Kim Scribner²*, Jeannette Kanefsky²

¹Quantitative Fisheries Center, Department of Fisheries and Wildlife, Michigan State University, 293 Farm Lane, Room 153, East Lansing, MI, 48824, USA
²Department of Fisheries and Wildlife, Michigan State University, 480 Wilson Road, Room 13, East Lansing, MI, 48824, USA

Title: Combining genetics with age/length data to estimate consistent changes in year-class strength of spawning populations contributing to admixtures, with application to Lake Michigan lake sturgeon

Abstract: We expanded model-based genetic stock identification methods to include age or length information of individuals from admixtures to estimate inter-annual changes in relative year-class strength of contributing spawning populations. The proposed methodology is intended for long-lived species with low post-recruitment mortality rates for which relatively consistent year-to-year changes in recruitment levels can be assumed. Age- and collection-year specific contributions to the admixture are modeled as a linear function of two estimated parameters for each population: an intercept that represents \( \log e \) of relative recruitment for the first modeled year class and a slope that represents how \( \log e \) of relative recruitment changes for each subsequent year class. Through simulations, we found that the estimation methodology performed reasonably well under a wide-range of conditions, including varying numbers of baseline spawning populations, levels of genetic divergence among spawning populations, degree of change in year-class strength, durations and frequencies of sampling from the mixture fishery, age range of individuals from the mixture fishery, and sample size from the mixture fishery. We demonstrate our methodology using genetic and length data for lake sturgeon \textit{Acipenser fulvescens} using admixture data from Green Bay in Lake Michigan, with spawning population data coming from five Lake Michigan tributaries (Fox, Manistee, Menominee, Muskegon, and Peshtigo rivers). We believe our proposed methodology holds promise as a tool for indexing changes in year-class strength of spawning populations contributing to admixtures, which can be beneficial for prioritizing rehabilitation or management efforts to protect spawning populations determined to be at risk.

Corresponding Author: scribne3@msu.edu
Oral or Poster: Oral

Presenter: Scribner, Kim

Co-Authors:
Thuy Yen Duong¹², James A. Crossman¹, Patrick S. Forsythe³, Edward A. Baker⁴, Kim T. Scribner⁵

¹Department of Fisheries and Wildlife, Michigan State University, 13 Natural Resources Building, East Lansing, MI 48824, USA.
²College of Aquaculture and Fisheries, Cantho University, Cantho, Vietnam.
³Department of Zoology, Michigan State University, 203 Natural Sciences, East Lansing, MI 48824, USA.
⁴Michigan Department of Natural Resources, 488 Cherry Creek Road, Marquette, MI 49855, USA.
⁵Department of Fisheries and Wildlife and Department of Integrative Biology, Michigan State University, 13 Natural Resources Building, East Lansing, MI 48824, USA.

Title: Genetic evidence reveals no reproductive isolation in the long-lived lake sturgeon (Acipenser fulvescens) with repeatability in spawning time

Abstract: Individual lake sturgeon have been observed to repeatedly spawn at the same time within the spawning distribution across multiple years. If repeatability in spawning date has endured over generations, reproductive isolation within the population may occur. We tested this prediction for adults captured in 9 years (2001-2009) in a closed population in Black Lake, Michigan, using genetic estimates of relatedness $r_{xy}$ and variance in allele frequency ($F_{ST}$). Evidence of isolation by time was lacking based on (i) small magnitude of $F_{ST}$ and small differences in $r_{xy}$ between groups of adults captured ≥ 2 years, (ii) no genetic difference among spawning groups within 5 of 7 years; and (iii) no relationship between inter-individual genetic relatedness and inter-individual differences in spawning time. Results based on genetically identified parentage for 7 years (2001-2007) showed that males exhibited considerable plasticity in mating behavior, where a proportion (7.7 – 46.4% across years) of males that spawned early remained in the river and mated with females that spawned later in the spawning season. The plasticity in male behavior and individual spawning time increased mating opportunities among individuals from early and late groups, thereby preventing temporal reproductive isolation.

Corresponding Author: scribne3@msu.edu
Oral or Poster: Oral

Presenter: Snobl, Zachary

Co-Authors:
Zachary Snobl\(^1,2\), Ryan Koenigs\(^1\), Daniel Isermann\(^3\), Joshua Raabe\(^4\)

\(^1\)Wisconsin Department of Natural Resources, Fisheries Management, 625 E. County Road Y, Suite 700, Oshkosh, WI 54901
\(^2\)Wisconsin Cooperative Fishery Research Unit, Fishery Analysis Center, College of Natural Resources, University of Wisconsin-Stevens Point, 800 Reserve St., Stevens Point, WI 54481
\(^3\)U.S. Geological Survey, Wisconsin Cooperative Fishery Research Unit, Fisheries Analysis Center, College of Natural Resources, University of Wisconsin-Stevens Point, 800 Reserve St., Stevens Point, WI 54481
\(^4\)College of Natural Resources, University of Wisconsin-Stevens Point, 800 Reserve St., Stevens Point, WI 54481

Title: Habitat use and movement of sub-adult lake sturgeon in the Lower Wolf River, Wisconsin

Abstract: Little is known regarding habitat use and movement of sub-adult lake sturgeon (\textit{Acipenser fulvescens}) in riverine portions of the Lake Winnebago system in Wisconsin. Understanding the behavior of sub-adult fish will improve lake sturgeon assessment by allowing biologists to better allocate sampling effort when targeting these fish. Our objective was 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 and quantified using GIS. Only 18 sub-adult lake sturgeon (66-127 cm) were implanted with radio transmitters in fall 2013 (\(n=12\)) and 2014 (\(n=6\)), despite sampling extensively with multiple gears including gill nets, set lines, electrofishing, and SCUBA. Fish were located approximately every 2 weeks and habitat variables were recorded at each location. Sub-adult lake sturgeon related to fine substrate in relatively deep water. Small sub-adult lake sturgeon (TL = 66-86 cm) tended to occupy smaller linear home ranges (4.2±3.8 km) than larger sub-adults (TL = 87-127 cm, mean home range = 119.1±68.4 km). Additionally, many sub-adult lake sturgeon appeared to make a prepubescent spawning run. Our results suggest few sub-adult lake sturgeon occupy the lower Wolf River. Consequently, sampling efforts targeting these fish should be focused elsewhere within the Lake Winnebago system.

Corresponding Author: Zachary.snobl@wisconsin.gov
Oral or Poster: Oral

Presenter: Stephenson, Sarah

Co-Authors:
Sarah Stephenson1, Pete Rust2, Shawn Young3

1Rare and Endangered Fish Biologist, BC Ministry of Forests, Lands and Natural Resource Operations; #401- 333 Victoria St. Nelson, BC V1L 4K3
2Idaho Fish and Game
3Kootenai Tribe of Idaho

Title: An evaluation of scute mark patterns as a backup identifier of Kootenay white sturgeon hatchery juveniles.

Abstract: White sturgeon (Acipenser transmontanus) field practices have long included the practice of removing a scute, or a scute pattern to denote capture, a treatment applied, or hatchery origin or brood year. However, there have been mixed reviews on the accuracy and practicality of scute removal patterns. All hatchery-origin juvenile Kootenay white sturgeon receive a lateral scute removal pattern, secondary to PIT tagging, in a select arrangement or side, to denote brood year and hatchery. There are now 20 years of release and recapture data in the Kootenay system and this study evaluates the scute accuracy from release to recapture. As of 2014, there were 5665 individuals from 19 different brood years (1992-2013) that had a scute pattern recorded prior to release and at least one traceable recapture event. The scute patterns recorded on capture were compared to release to determine read accuracy and to identify scute removal patterns that were most dependable. The main findings were that scute patterns were more accurately read when only removed on one side and when a gap between scutes removed, versus the removed scute lateral count, was used to denote brood year and hatchery. Additionally, a smaller gap was more dependably read. We would argue that scutes are an important way to double tag juvenile sturgeon and this analysis suggests shifting to documenting the gap count, or a series of gaps, as the preferred method of brood year identification and to assign brood year to those individuals that did receive an additional tag type.

Corresponding Author: Sarah.Stephenson@gov.bc.ca
Oral or Poster: Oral

Presenter: Talmage, Phil

Co-Authors:
Phil Talmage

1Minnesota Department of Natural Resources, 204 Main Street East, Baudette, MN

Title: A look back and forward: Lake sturgeon recovery and management in Minnesota rivers and lakes

Abstract: Over-harvest, water quality and habitat degradation, and impairments to connectivity nearly extirpated Lake Sturgeon Acipenser fulvescens from every river system in Minnesota by the early to mid-1900s. Lake Sturgeon was listed as a “Species of Special Concern” in Minnesota in 1984. Through fishing closures, clean water legislation, habitat improvements, restored connectivity, and re-introductions populations have begun and continue to recover. The current status of population recoveries across the state varies from well progressed (Lake of the Woods and Rainy River system) where short-term population goals were met to recent re-introductions in the upper reaches of the Red and Minnesota rivers. Lake Sturgeon are growing in popularity among Minnesota anglers and some systems, such as the Rainy River, are supporting active destination fisheries with regulated harvest. Opportunities for anglers to pursue Lake Sturgeon are expanding as the species continues its recovery.

Corresponding Author: phil.talmage@state.mn.us
Oral or Poster: Oral

Presenter: Tews, Anne

Co-Authors:
Anne Tews

1Montana Fish Wildlife and Parks, P.O. Box 938, Lewistown, MT 59456

Title: Fine tuning the relationship between shovelnose sturgeon spawning and discharge in a tributary to the Missouri River, Montana

Abstract: The lower Marias River, Montana is regulated by Tiber dam and is the largest tributary, in the 380 km reach of the Missouri River between Morony Dam and Fort Peck Reservoir. Recent studies indicated shovelnose sturgeon (Scaphirhynchus platorynchus) spawning success was related to discharge and suggested 28 m³/s as the spawning cue in the Marias River. However, peak June flows have been at least 85 m³/s during all documented shovelnose sturgeon spawning in the Marias River from 1978 - 2009. In this study, controlled flow releases from Tiber Dam of 28 m³/s in 2012 and 56 m³/s cfs in 2013 were utilized to clarify minimum flow needs for shovelnose sturgeon spawning. Larval fish samples were collected at two sites in the Marias from May - July both years. Shovelnose sturgeon spawning was not documented during the lower flow regime, but was verified at 56 m³/s. Temperatures were suitable for spawning both years. Radio telemetry data also found adult shovelnose sturgeon use in the Marias River was 2 – 3 times higher when peak June flows were at least 56 m³/s. This work indicates shovelnose sturgeon spawning may be tied to a trigger flow for migration coupled with a minimum spawning flow. It has implications for flow management of Tiber dam and for pallid sturgeon (S. albus) recovery.

Corresponding Author: antews@mt.gov
Oral or Poster: Oral

Presenter: Van Walleghem, Elissa

Co-Authors:
Elissa JD Van Walleghem\textsuperscript{1,3}* , Eric D Anderson\textsuperscript{2}, Sharon C Clouthier\textsuperscript{3}

\textsuperscript{1} University of Manitoba, Department of Biological Sciences, Winnipeg, MB, R3T 2N2, Canada
\textsuperscript{2} Box 28, Group 30, RR2, Ste Anne, MB, R5H1R2, Canada
\textsuperscript{3} Fisheries & Oceans Canada, Freshwater Institute, 501 University Crescent, Winnipeg, Manitoba R3T 2N6, Canada

Title: Application of a quantitative PCR test for detection of Namao Virus in a lake sturgeon conservation stocking program

Abstract: Namao virus (NV) was associated with mortality in juvenile lake sturgeon \textit{Acipenser fulvescens} reared as part of a conservation stocking program for this endangered species in Manitoba, Canada. A quantitative polymerase chain reaction (qPCR) test was developed for detection of NV and applied as a disease management tool to screen gametes, progeny and tissue from broodstock in the Nelson River and Winnipeg River. Positive test results with somatic tissue samples collected from 2010 to 2014 revealed that NV is endemic in the Nelson River water basin in Manitoba. None of the reproductive products tested positive. Virus load in these samples was low with quantities ranging from \textless{}3 to 830 equivalent plasmid copies per µg DNA. The qPCR test was also used to evaluate virus transmission patterns in sturgeon challenged with NV through exposure to water containing virus or by direct contact with infected individuals. Positive test results with tissue samples (n=8 per fish) collected from dead or moribund fish over the 17 week study provided evidence of virus transmission albeit at a low frequency. NV was found in gill and abdominal skin tissue in 82\% and 27\% of the positive fish, respectively. The gills appeared to be the initial site of infection with virus persisting in the head skin tissue for up to 62 days. The qPCR test should improve the accuracy of diagnosis for this virus and will serve as a critical tool for disease management by reducing the risk of introducing disease into wild populations of sturgeon.

Corresponding Author: elissa.vanwalleghem@dfo-mpo.gc.ca
Oral or Poster: Oral

Presenter: Webb, Molly

Co-Authors:
Molly A.H. Webb¹, Brad J. Cady², Brad W. James², Kevin M. Kappenman¹

¹U.S. Fish and Wildlife Service, Bozeman Fish Technology Center, 4050 Bridger Canyon Road, Bozeman, Montana 59715, USA
²Washington Department of Fish and Wildlife, 2108 Grand Boulevard, Vancouver, WA 98661, USA

Title: Reproductive structure of adult wild white sturgeon in the Lower Columbia River: Can reproductive structure be used to assess population level productivity?

Abstract: Reproductive structure (RS) of adult White Sturgeon (WS), Acipenser transmontanus, population below Bonneville Dam in the Columbia River (touted to be the healthiest population of sturgeon in the world) was assessed every spring from 2000-2011 and compared to the RS of adults in Bonneville Reservoir (a population known to show contaminant and overcrowding effects) in 2012 and 2014. Sex and stage of maturity was determined for 758 WS below Bonneville Dam and 135 WS in Bonneville Reservoir. The female RS below Bonneville Dam was 65% pre-vitellogenic, 24% vitellogenic, 2% post-vitellogenic/ripe, 6% postovulatory, and 3% of the females were undergoing follicular atresia. Proportionally, there were slightly more pre-vitellogenic females (4%) and vitellogenic females (4%) in Bonneville Reservoir compared to below Bonneville Dam and less than half of the females were capable of reproducing at the onset of the spawning season in Bonneville Reservoir (4%) compared to below Bonneville Dam where 11% of the females were reproducing or undergoing follicular atresia annually. Of the males below Bonneville Dam, 69% were pre-meiotic, 13% were mid-spermatogenic, 13% were spermiating, and 5% were post-spermiation. In Bonneville Reservoir, there were slightly more pre-meiotic males (9%), less mid-meiotic males (7%), no spermiating males, and more post-spermiation males (11%). Proportionally, the number of reproducing males (spermiating plus post-spermiation) was similar in Bonneville Reservoir (16%) compared to below Bonneville Dam (18%). The significant reduction in the proportion of reproductive female WS in Bonneville Reservoir indicates a population level effect, and RS may be a good indicator of population level productivity.

Corresponding Author: Molly_Webb@fws.gov
Oral or Poster: Oral

Presenter: Webb, Molly

Authors:
Christopher S. Guy¹, Hilary B. Treanor², Kevin M. Kappenman³, Eric A. Scholl², Jason E. Ilgen³, Molly A. H. Webb³

¹USGS, Montana Cooperative Fishery Research Unit, Department of Ecology, Fish and Wildlife Ecology and Management Program, Montana State University, Bozeman, Montana 59717, USA.
²Montana State University, Department of Ecology, Bozeman, Montana 59717, USA.
³U. S. Fish and Wildlife Service, Bozeman Fish Technology Center, Bozeman, Montana, 59715, USA.

Title: Forgotten dead zone hinders conservation of pallid sturgeon

Abstract: The global proliferation of dams within the last half century has prompted ecologists to understand the effects of regulated rivers on large-river fishes. Currently, much of the effort to mitigate the influence of dams on large-river fishes has been focused on downriver effects and little attention has been given to upriver effects. Through a combination of field observations and laboratory experiments, we tested the hypothesis that abiotic conditions upriver of the dam are the mechanism for the lack of recruitment in pallid sturgeon (Scaphirhynchus albus), an iconic large-river endangered species. Here we show for the first time that anoxic upriver habitat in reservoirs (i.e., the transition zone between the river and reservoir) is responsible for the lack of recruitment in pallid sturgeon. The anoxic condition in the transition zone is a function of reduced river velocities and the concentration of fine particulate organic material with high microbial respiration. As predicted, the river was oxic at all sampling locations. Our results indicate reservoirs are an ecological sink for pallid sturgeon. A paradigm shift in regulated-river management that includes upriver effects of reservoirs is needed to conserve pallid sturgeon and likely other large-river fishes.

Corresponding Author: Molly_Webb@fws.gov
Oral or Poster: Oral

Presenter: Willett, Naeem

Co-Authors:
Naeem Willett¹, Stephania Bolden², Dewayne Fox¹

¹ Delaware State University, 1200 North DuPont Highway, Dover Delaware 19901
² Protected Resources, NOAA Fisheries Southeast Regional Office, St. Petersburg, FL, 33701

Title: Running the gauntlet: Examining Gulf Sturgeon river entry through an active construction zone-

Abstract: Adult and sub-adult Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) are believed to forage exclusively in marine and estuarine waters before returning to rivers in the spring. In many systems including the Choctawhatchee River, FL populations are recovering after over harvest and habitat loss/destruction led to being listed under the ESA in 1991. Although harvest is not prohibited and habitat conservation measures have been implemented there are still a number of threats including the development and alternation of shoreline habitats. During late February to late June, 2015 we deployed an array of VEMCO Ltd VR2W receivers (n=15) in a systematic fashion in areas bordering a large scale bridge construction project taking place in Choctawhatchee Bay through which migrating Gulf Sturgeon had to pass. We also placed an additional seven acoustic receivers in the lower 10km reaches and distributaries of the Choctawhatchee River. A total of 120 previously telemetered Gulf Sturgeon were recorded in the array. When moving through the array in the lower reaches of the river, Gulf Sturgeon residence times ranged from one to five days and primarily used two of the four distributaries. We are currently examining these data to better understand the impact of construction activities by comparing construction activities to sturgeon movements and residency times. We hope that our study will provide managers with much needed information on the potential impacts of construction on Gulf Sturgeon behavior thereby improving recovery prospects for this species.

Corresponding Author: nwillett45@gmail.com
ABSTRACTS FOR POSTER SESSION
Title: Understanding strontium metabolism as a potential elemental marker in juvenile lake sturgeon

Abstract: Deposition of elements in bony structures of fish have long been used to infer origin, movement and life history events. Some of the more frequently used elements include strontium (Sr) and barium (Ba), due to their similarity in charge and size to the alkaline earth metal, calcium. Interestingly, while a multitude of studies exist using Sr and Ba to infer life history events in fishes, there are few empirical studies examining the movement and retention of these elements within the fish. The aim of the present study was to determine how strontium was handled as an element by juvenile Lake Sturgeon thus allowing stronger inference of life history based on elemental signatures deposited in the bony tissue. We examined flux rate, tissue deposition and half-life and persistence of strontium as a potential elemental marker in Lake Sturgeon, *Acipenser fulvescens*. Using the radioisotope $^{85}$Sr we demonstrate a strong inward flux of the element, as described for calcium in similar sized Lake Sturgeon. Short-term accumulation was found to be highest in the pectoral fin ray where the elemental signature remained detectable for at least 510 days post marking. Results confirm that the movement and handling of strontium in Lake Sturgeon follows similar patterns as calcium and that strontium could be used to infer life history of Lake Sturgeon.

Corresponding Author: Gary.Anderson@umanitoba.ca
Title: Genetic assessment of a fragmented Mattagami River, Ontario lake sturgeon population post adult translocation effort

Abstract: Lake sturgeon (Acipenser fulvescens) underwent historical overharvest throughout their distribution which led to endangered species listing, and subsequent protection and recovery efforts. Despite this, many populations do not appear to be recovering; habitat alteration and fragmentation are thought to be integral impediments to lake sturgeon recovery. Reintroductions and augmentations have the potential to speed lake sturgeon recovery through reduced dependence on natural recolonization, and allowing recolonization of areas that are inaccessible due to fragmentation from anthropogenic development. Genetic information regarding the initial relocation and genetic monitoring post-relocation are of critical importance to relocation success, long-term persistence of reintroduced populations, and informing future relocation efforts. In 2002, 52 adult lake sturgeon were relocated from the Little Long population, located below the confluence of the Mattagami, Kapuskasing, and Groundhog Rivers, upstream to a fragmented stretch of the Mattagami River, between the Wawaitin and Sandy Falls generating stations. Adult and juvenile lake sturgeon from the reintroduced (n=51) and source population (n=42) were genotyped at 14 microsatellite loci. Genetic analyses included a comparison of translocated population and source population genetic diversity, a translocated population effective breeder size estimate, and a parentage analysis of adults and juveniles from the reintroduced population. Preliminary results indicate that much of the source genetic diversity was captured in the translocation effort. Translocated adults were related to juveniles within the population, suggesting the adult transfer was successful, and may be a useful tool for reintroduction of lake sturgeon into extirpated areas or augmentation of struggling populations.

Corresponding Author: margaretbooth@trentu.ca
Oral or Poster: Poster

Presenter: Buhl, Kevin

Authors:
Kevin J. Buhl\textsuperscript{1}, Travis W. Schaeffer\textsuperscript{2}

\textsuperscript{1}USGS, CERC-Yankton Field Research Station, 31247 436\textsuperscript{th} Avenue, Yankton, SD 57078, (605) 665-9217, kevin\_buhl@usgs.gov.
\textsuperscript{2}USGS, CERC-Yankton Field Research Station

Title: Survival and drift behavior of pallid sturgeon free embryos in an artificial channel

Abstract: Laboratory studies were conducted to quantify survival and drift behaviors of free embryo and larval pallid sturgeon (\textit{Scaphirhynchus albus}) and to assess their tolerance to different water velocities. Drift behavior experiments were conducted in two artificial channels consisting of large fiberglass oval flumes. Both flumes used pressurized water to produce nominal water velocities of 0.15 m/s. Flumes were nearly identical except for differences in the water delivery system to improve survival. Each flume was stocked with 10 newly-hatched free embryos. Survival and dispersal behavior were monitored every three hours through 23 days post-hatch (dph). There was no statistical difference in the overall survival of fish between flumes after 23 days. There was a significant reduction in the mean number of fish passes/minute and estimated drift velocity as the fish aged and we observed fish holding position along the bottom in the two flumes at 12 and 14 dph. In a separate velocity challenge study conducted in circular tanks, newly-hatched free embryos were exposed to velocities ranging from 0.00-0.21 m/s for 21 days. Survival in the two highest velocity treatments (0.15 and 0.21 m/s) was significantly reduced compared to the control (0.00 m/s) and lower velocities (0.05, 0.06, and 0.07 m/s).

Corresponding Author: kevin\_buhl@usgs.gov
Oral or Poster: Poster

Presenter: Dammerman, Kari

Authors:
K.J. Dammerman¹, J.P. Steibel²,³, K.T. Scribner¹,³

¹Department of Zoology, Michigan State University, 228 Farm Lane Rm 203, East Lansing, MI 48824, USA
²Department of Animal Science, Michigan State University, 474 S Shaw Lane, East Lansing, MI 48824, USA
³Department of Fisheries and Wildlife, Michigan State University, 480 Wilson Road Rm 13, East Lansing, MI 48824

Title: Effects of parentage and microhabitat variation within adult-selected spawning sites on Lake sturgeon growth during early life stages

Abstract: Understanding the impact of environmental variation on organismal traits during early life stages is essential for predicting changes in populations. Maternal effects including oviposition site selection are one source of variation. Female choice of sites can vary based on microhabitat variation which directly affects larval development and survival. However, the persistence of microhabitat effects across sequential early ontogenetic stages is limited. In 2013, we collected fertilized lake sturgeon (Acipenser fulvescens) eggs from the Black River, Michigan, just prior to hatch from an adult-selected spawning location, and quantified three microhabitat variables (water depth, discharge, and substrate size). Larval body length, body area, and yolk-sac area were quantified at hatch. Body size was measured for an additional four weeks post-emergence. Genetic-based parentage analysis was conducted using fin clips. The traits at hatch varied due to the microhabitat variables, but not due to additive genetic effects. Growth significantly varied among larvae with the greatest range in body size observed at 41 days post-hatch. Additive genetic variance covaried with age. Narrow-sense heritability estimates for body length ranged from 0.45 to 0.64. Results demonstrate that female-selected, microhabitat variation influenced offspring phenotypic variation at hatch, but had no influence on body length at sequential ontogenetic stages. Additionally, the additive genetic effects explained roughly half the variation observed in body size, but individuals showed considerable variation in growth which may be due to differences in the degree of plasticity among individuals.

Corresponding Author: kjdammerman@gmail.com
Oral or Poster: Poster

Presenter: Dunton, Keith

Authors:
Keith J. Dunton 1*, Lisa A. Bonacci 2, Michael G. Frisk 3, Kevin W. Wark 4, and Dewayne A. Fox 1

1 Delaware State University, Department of Agriculture and Natural Resources, 1200 N. DuPont Highway, Dover, DE 19901.
2 New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, Bureau of Marine Resources, 205 North Belle Mead Road, Suite 1, East Setauket, New York, 11733
3 School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, NY, 11794-5000
4 Endeavor Fisheries, 8 West 8th, Barnegat Light, NJ 08006.

Title: Atlantic Sturgeon behavior in proximity to large mesh sink gillnets in marine waters

Abstract: The sink-gillnets employed in the Goosefish (Lophius americanus) fishery have been identified as a significant source of mortality for the federally endangered Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus). There is much concern within the fishing industry, that conservation measures to reduce both incidental take and mortality rates of sturgeon may be required. Proposed alternative fishing practices may have the potential to decrease Atlantic Sturgeon encounter rates and post-release mortality rates. During the spring of 2015, we deployed a VEMCO Ltd. Positioning System (VPS) off the coast of Delaware to assess the behavior and interactions of telemetered Atlantic Sturgeon in the vicinity of three sink-gillnet treatments. During the course of the study we fished two strings of gillnets a total of 86 times for 2-4 hour intervals. Each net was comprised of nine 91.4m panels tied together to form a continuous string that were fished within the boundaries of the VPS and also affixed with acoustic transmitters at the junction of individual panels to provide position estimates for individual treatments. Atlantic Sturgeon landings were much greater in the industry standard control nets than compared to the lower profile and larger mesh experimental nets providing evidence that net changes in net configuration may influence sturgeon behavior. Over the course of the approximately two month study we detected a large number of telemetered Atlantic Sturgeon (n=458) within our study boundaries. Fine-scale position estimates will be examined to determine if interactions of Atlantic sturgeon occurred with each net treatment.

Corresponding Author: keith.joseph.dunton@gmail.com
**Oral or Poster: Poster**

**Presenter:** Giannetta, Garrett

**Authors:**
Garrett D. Giannetta¹, Zachary J. Jackson¹

¹U.S. Fish and Wildlife Service, 850 S. Guild Avenue, Suite 105, Lodi, California 95240, USA

**Title:** Otolith extraction techniques for white sturgeon

**Abstract:** Age and growth studies have long been a critical tool in managing the White Sturgeon *Acipenser transmontanus* population in the San Francisco Estuary watershed. Pectoral fin rays have been the preferred non-lethal structure for age estimation. Currently, several research groups are investigating questions involving White Sturgeon fin rays and otoliths including evaluation of the use of boney structures for tracking contaminant exposure histories, microchemistry to evaluate origin and freshwater movements, and comparing age estimates between structures. Samples were collected from live and harvested fish from a variety of sources throughout the watershed (e.g., research and monitoring programs, fishing tournaments, confiscated fish). Since otolith removal is not well documented for White Sturgeon, we took the opportunity to practice and refine our techniques on harvested fish and were able to determine the position of the otoliths. We explored multiple techniques (e.g., wedge cut, anterior sagittal split, frontal excision) using various tools, and developed protocols for otolith removal under various field conditions. Data resulting from the collection and analysis of otoliths and pectoral fin rays will not only give us a better understanding of the health of the population, but will be used to inform future management decisions implemented to increase abundance of White Sturgeon.

**Corresponding Author:** Garrett_Giannetta@fws.gov
Oral or Poster: Poster

Presenter: Hegna, Jonathan

Authors:
Jonathan Hegna¹, Edward Baker², Kim Scribner¹

¹Department of Fisheries and Wildlife, Michigan State University
²Michigan Department of Natural Resources

Title: Juvenile lake sturgeon downstream passage and survival at two hydroelectric dams

Abstract: Development of hydroelectric power fragmented lake sturgeon (Acipenser fulvescens) populations and reduced the amount of available juvenile rearing and adult spawning habitat available to populations. Downstream passage behavior and survival of juvenile lake sturgeon at hydroelectric dams is poorly understood. We used stream-wide RFID antennas and PIT-tags to monitor passage and survival through two different hydroelectric dams along the Black River, Michigan. A total of 54 age-1 and 300 age-0 lake sturgeon were released above both Tower Dam and Kleber Dam. Between September and December of 2014, a total of 22 (40%) age-1 and 46 (15%) age-0 lake sturgeon survived passage through the upper dam (Tower Dam), while 26 (24%) age-1 and 39 (6.5%) age-0 lake sturgeon survived passage through the lower dam (Kleber Dam). In addition, 14 (26%) age-1 and 10 (3.3%) age-0 lake sturgeon survived passage through both hydroelectric dams. Seven (13%) age-1 lake sturgeon were found dead on the 1-inch trash racks at Tower Dam, while no lake sturgeon were recovered on the 3-inch trash racks at Kleber Dam. Most Passage events took place within the first two weeks, and passage events primarily took place at night (92%) at both dams. The results of this study suggest that juvenile lake sturgeon will move rapidly through small reservoirs, survive passage through hydroelectric dams, and that trash rack spacing may play a significant role in passage mortality.

Corresponding Author: jonathanhegna@gmail.com
Oral or Poster: Poster

Presenter: Henderson, Laura

Authors:
Laura Henderson¹, Craig MacDougall¹

¹North/South Consultants Inc., 83 Scurfield Blvd., Winnipeg, Manitoba

Title: Growth of stocked juvenile Lake Sturgeon in the upper Nelson River

Abstract: During the early 1990s, Lake Sturgeon, *Acipenser fulvescens*, populations in the upper Nelson River were believed to have been nearly extirpated as a result of historical (e.g., overexploitation) and contemporary (e.g., hydroelectric development) factors. Since natural recruitment for the area was uncertain, hatchery rearing and stocking of early life stages was initiated as a critical component for population recovery. Between 1994 and 2014, 87,770 larvae, 33,605 fingerlings (age-0), 3,034 yearlings (age-1), and 26 age-2 individuals have been stocked in the Sea Falls to Sugar Falls reach of the Nelson River. Of the 3,060 age-1 and age-2 Lake Sturgeon stocked, 96.5% (n = 2,953) were marked with Passive Integrated Transponder (PIT) tags. During fall of 2012-2014, Lake Sturgeon population inventories were conducted using gill nets to determine the success of ongoing stocking initiatives and evaluate aspects such as growth. Following three years of assessment, a total of 315 Lake Sturgeon were captured, of which 85.4% (n = 269) possessed PIT tags. Length-at-age by cohort analysis indicated a growth trajectory head-start for fish that overwinter in a hatchery (i.e., released at age-1), and that size differences developed early in life may persist throughout the juvenile life stage. Individuals released early during the open-water season (May-June) also grew at comparable or higher rates than fish remaining in the hatchery until fall. Stocking efforts have resulted in the reestablishment of juvenile Lake Sturgeon in this reach of the Nelson River; however, juvenile density is low compared to ‘healthy’ Manitoba populations. Continued monitoring and potential deviations and/or alterations in experimental approach will help refine stocking success.

Corresponding Author: LHenderson@nscons.ca
Oral or Poster: Poster

Presenter: Love, Seth

Authors:
Seth A. Love\textsuperscript{1*}, Quinton E. Phelps\textsuperscript{2}, Scott J. Schluetter\textsuperscript{3}, and Rodger M. Klindt\textsuperscript{4}

\textsuperscript{1}Southeast Missouri State University
\textsuperscript{2}Missouri Department of Conservation
\textsuperscript{3}United States Fish and Wildlife Service
\textsuperscript{4}New York State Department of Environmental Conservation

Title: The feasibility of lake sturgeon microchemistry in the St. Lawrence River

Abstract: Due to serious declines, a number of U.S. states and Canadian provinces have developed and implemented Lake Sturgeon (\textit{Acipenser fulvescens}) recovery plans. As a component of their recovery efforts, the New York State Department of Environmental Conservation (NYSDEC) began stocking Lake Sturgeon fall fingerlings in 1995 to maintain, restore, and create populations in 12 river and lake systems within the state. These include Black Lake, Oneida Lake, Oswegatchie River, and St. Lawrence River. While there does appear to be an increase in catch rates in the St. Lawrence River (above the Moses-Saunders hydropower facility), the origins and movement patterns of these fish are somewhat unknown. The objective of this study is to assess the feasibility of using pectoral fin ray microchemistry to determine environmental life history of Lake Sturgeon in St. Lawrence River. To accomplish this objective, a microchemical analysis was conducted on water samples from 10 sites on the St. Lawrence River, its tributaries, and the DEC Oneida Fish Hatchery. The results indicate a strong Sr:Ca difference (i.e., >20 units) between the hatchery sample and St. Lawrence River system samples. These encouraging results suggest that Sr:Ca could be utilized to differentiate between hatchery origin and wild sturgeon.

Corresponding Author: seth.love12@houghton.edu
Oral or Poster: Poster

Presenter: Meronek, Tom

Authors: Tom Meronek

1Wisconsin Department of Natural Resources, Bureau of Fisheries Management, Wausau, WI

Title: Restoration of lake sturgeon in the Wisconsin River

Abstract: The Wisconsin Department of Natural Resources restoration of lake sturgeon Acipenser fulvescens, in the Wisconsin River near Stevens Point started in 1991 with the introduction of adult lake sturgeon transplanted from Lake Wisconsin. By 1997, they had developed an egg taking program using fish collected below the Kilbourn Dam on the Wisconsin River and Wisconsin Dells. The lake sturgeon re-introduction program has been successful with more than 250,000 lake sturgeon stocked in the river at Stevens Point and areas further north, mostly as fall fingerlings. In addition to the fingerlings, nearly 2800 yearling lake sturgeon have been stocked below Merrill Dam and Dubay Dam on the Wisconsin River. Part of the restoration program included tagging 20 yearlings with radio transmitters and releasing them during August 2005. The project tracked the movement of these fish to preferred habitat areas and determined the extent of their migration downstream. The lake sturgeon moved on average about 6 miles from their stocking site and habitat selection was split nearly equally, between fish either moving upstream to Lake Dubay Dam, or downstream near Lakeside Bay on the Stevens Point Flowage, Wisconsin River. This work helped the Wisconsin Department of Natural Resources in the formulation of future stocking and restoration strategies.

Corresponding Author: thomas.meronek@wisconsin.gov
Oral or Poster: Poster

Presenter: Ross, Dillon

Authors:
Dillon F. Ross¹, John M. Bauman¹, Edward A. Baker¹, Kim T. Scribner¹

¹Department of Fisheries and Wildlife, Michigan State University, 13 Natural Resources Building, East Lansing, Michigan 48824, USA

Title: Migration behavior of spawning lake sturgeon (*Acipenser fulvescens*) in the Upper Black River, MI

Abstract: Migration is necessary but costly for many adfluvial fish species including Lake sturgeon (*Acipenser fulvescens*). Understanding how biological and physical features of stream environments affect migratory and spawning behavior and reproductive effort is important for the species’ conservation. Reproductive migrations of lake sturgeon from lake into riverine systems are affected by environmental cues. Adult sturgeon (~1200) have been tagged with Oregon RFID PIT tags which permits passive observations of adult movement as they migrate upstream in the Upper Black River to spawn. Information collected from two PIT tag antennas, one placed at the river mouth and one immediately below the spawning area, provide information on movements to and from the spawning area and residence times of males and females in the river during 2014 and 2015. Upstream travel time for individuals in 2014 varied between 8 and 44 hours. Effects of the duration of migration (a measure of reproductive effort) will be discussed relative to sex, total length, as well as environmental effects of discharge and temperature. Further analyses in the data could show relative abundance in sex ratio in the spawning area and inter-spawning interval effecting the duration of migration as well. Understanding the underlying features that give rise to inter-individual variation in migratory and spawning behaviors and their combined effects on current and future reproductive success is critical to predict natural rates of lake sturgeon recruitment and will better inform management of this imperiled species.

Corresponding Author: dillonross9392@gmail.com
Oral or Poster: Poster

Presenter: Ruzich, Jenna

Authors:
Jenna Ruzich\textsuperscript{1}, John M. Bauman\textsuperscript{1}, Kim T. Scribner\textsuperscript{1}

\textsuperscript{1}Department of Fisheries and Wildlife, Michigan State University, 13 Natural Resources Building, East Lansing, Michigan 48824, USA

Title: Effects of alternative food types on larval lake sturgeon body size and survival

Abstract: Resources and manpower required for successful fish culture in stream-side facilities can be costly based on feeding schedules and the food types used. Species such as Lake Sturgeon (\textit{Acipenser fulvescens}) require multiple feedings per day to ensure adequate growth and high rates of survival. Larval Lake Sturgeon are typically fed live brine shrimp (\textit{Artemia}), which involves culturing and harvesting multiple times per day. If larvae are able to effectively feed on alternative food types, production costs could be substantially reduced. The effects of four food types, live brine shrimp (LBS), frozen (thawed) brine shrimp (FBS), decapsulated brine shrimp eggs (DBS), and a 1:1 frozen (thawed) brine and decapsulated egg mixture (FDBSM), on larval Lake Sturgeon body size and survival was examined for three weeks from the onset of exogenous feeding using individuals from two families. Larvae from both families fed a LBS diet had significantly higher survival compared to those fed alternate food types. Larvae fed LBS also had a significantly greater mass (weight) and total length (TL) than fish from other treatment types. Differences among families were observed for TL and survival. The results from this experiment suggest that larval Lake Sturgeon prefer live food; perhaps attributed to a vibratory response that elicits initiation of feeding. Additional research is needed pertaining to alternate ‘live’ food types (e.g., daphnia) that may decrease labor and production costs without compromising aquaculture production goals and fish quality.

Corresponding Author: ruzichjk@gmail.com
Oral or Poster: Poster

Presenter: Valentine, Shaley

Authors:
Shaley A. Valentine¹, John M. Bauman¹, Kim T. Scribner¹

¹Department of Fisheries and Wildlife, Michigan State University, 13 Natural Resources Building, East Lansing, Michigan 48824, USA

Title: Effects of alternative foods on body size and survival of larval lake sturgeon

Abstract:
In aquaculture, offering live food such as Artemia spp. is associated with greater larval rearing success; however, labor and resource costs are comparatively high. In a five week study at the Black River Streamside Hatchery, the effects of potentially cost-effective alternative food types on body size and survival of larval Lake Sturgeon (Acipenser fulvescens) were determined. Live Artemia was fed as a control and two alternate food types were utilized: frozen Artemia (FA) and trout crumble starter diet (TD). At the onset of exogenous feeding, live Artemia was fed for two weeks, followed by a week-long transition to FA or TD, ending with two weeks of continuous FA or TD feeding. Significant treatment effects on total length (TL; mm), weight per fish (g), and proportional survival were documented. Mean (±SE) TL was significantly greater among control fish (54.8 ±0.61) compared to those fed FA (41.8 ±0.03) or TD (48.0 ±0.57; P < 0.0001). In addition, mean weight per fish was significantly greater among control fish (0.59 ±0.01) compared to those fed FA (0.21 ±0.00), or TD (0.31 ±0.01; P < 0.0001). Mean proportional survival of control fish (0.98 ±0.02) and fish fed FA (0.98 ±0.02) were significantly higher compared to those fed TD (0.19 ±0.05; P = 0.023). Results suggest larval Lake Sturgeon did not transition to TD or FA during the first few weeks after initiation of exogenous feeding. Additional transition studies are needed using alternate food types to identify more cost effective, less labor intensive food types.

Corresponding Author: shaleyvalentine@gmail.com
Oral or Poster: Poster

Presenter: Ryan Walquist

Authors:
Ryan Walquist¹, John Bauman¹, Kim T. Scribner¹

¹Department of Fisheries and Wildlife, Michigan State University, 13 Natural Resources Building, East Lansing, Michigan 48824, USA

Title: Effects of benthic macroinvertebrates on the body size and survival of Lake Sturgeon (*Acipenser fulvescens*) eggs and free embryos.

Abstract:
There is considerable overlap in Lake Sturgeon (*Acipenser fulvescens*) spawning habitats and the distribution of benthic macroinvertebrates, suggesting that species interactions may be common. However, documentation of ways in which macroinvertebrate functional feeding guilds may influence survival, growth, and ultimately recruitment of Lake Sturgeon is limited. In this study, Lake Sturgeon eggs were fertilized (one family) and incubated separately in one of five experimental treatment groups to quantify the effects of macroinvertebrates on egg size and days to 100% hatch. In addition, body size (total length and yolk-sac area) and proportional survival of free embryos at hatch were quantified. Experimental treatment groups included predators (Perlidae), facultative-scrapers (Heptageniidae), obligate-scrapers (Helicopsychidae), collector-filterers (Isonychiidae), and a control. Mean egg size was significantly smaller (3.42 ±0.04) and days to hatch was significantly less (5.3 ±0.3) after exposure to the predator stonefly compared to the control treatments (3.72 ±0.06; 6.8 ±0.3, respectively). Mean total length (12.72 ±0.17) and mean yolk sac area (7.69 ±0.12) at hatch in the control treatment were significantly greater than the predator treatment (11.33 ±0.15; 6.99 ±0.06, respectively). Proportional survival at hatch did not differ significantly by treatment. However, mean survival of eggs incubated in the presence of a predator (0.27 ±0.1) was lower than those incubated in the control treatment (0.53 ±0.11). Macroinvertebrate presence in Lake Sturgeon spawning areas should be considered a significant biotic factor influencing recruitment due to their effects on egg size and the days to hatch, total length, and yolk sac area of the free embryos.

Corresponding Author: walquis4@msu.edu
Oral or Poster: Poster

Presenter: Waraniak, Justin

Authors:
Justin Waraniak¹, Kim Scribner¹, Nicholas Gezon¹, Edward Baker²

¹Department of Fisheries and Wildlife, Michigan State University, 13 Natural Resources Building, East Lansing, MI 48824, USA
²Michigan Department of Natural Resources

Title: Predation of larval lake sturgeon by piscine predators in the Black River, Michigan

Abstract: Mortality in larval fishes can be a significant factor to population levels of recruitment, especially in species with high early life stage mortality like lake sturgeon (Acipenser fulvescens). However, the role predation plays in larval mortality is not well known. We investigated predation of larval sturgeon through field surveys that focused on estimating larval loss and by quantifying the composition of potential predator communities. Drift nets were deployed at ~500m intervals to enumerate larval abundance and loss for ten nights. Electrofishing surveys were conducted during the day following larval sampling events between the drift sites. Laboratory studies were conducted to examine the vulnerability of larval fish to 20 species of piscine predators present in the Black River. Sturgeon, white sucker (Catostomus commersoni), and silver redhorse (Moxostoma anisurum) larvae were introduced to potential predators in small tanks or an artificial flowing stream. Photographs were taken before and after trials to determine the number of larvae consumed as well as any size-selective predation. Preliminary results suggest several commonly occurring species, including rock bass (Ambloplites rupestris), pumpkinseed (Lepomis microlophus), and hornyhead chub (Nocomis biguttatus), have a strong preference for sturgeon larvae. This combination of field and laboratory studies allows us to relate the abundance of known larval sturgeon predators to larval loss, and suggests that predation by adult and juvenile fish may be an important source of mortality for larval sturgeon.

Corresponding Author: warania1@msu.edu
Oral or Poster: Poster

Presenter: Wassink, Lydia

Authors:
Lydia Wassink¹, Kim Scribner¹

¹Department of Fisheries and Wildlife, Michigan State University, 13 Natural Resources Building, East Lansing, MI 48824, USA

Title: Behavioral responses of larval lake sturgeon to odorant cues

Abstract: Environmental cues are known to influence the development of sensory perception and thus affect behavior. Larval fish have been shown to respond to olfactory cues from live predators and dead conspecifics, but ontogenetic changes in perception abilities, in behavioral responses expressed, at and subsequent to initial exposure to live predators have not previously been studied in larval lake sturgeon (Acipenser fulvescens). Larval sturgeon of various ages raised at the Black River stream-side hatchery in Onaway, Michigan were exposed to odorant from live potential predators or dead conspecifics. Several predators were used including crayfish, burbot, rock bass, and northern pike, all common year-round predators in the streams occupied by lake sturgeon. The time taken to traverse the entire raceway length away from the potential predator was used as the response variable. A control set of individuals was timed without exposure to the same odorant. Predator diet was examined as a variable to determine if predators that had been feeding on sturgeon larvae produced a more intense avoidance response in larval sturgeon. Results suggest that larval sturgeon between 20 and 30 days of age responded to odorant cues and distinguished sturgeon odor from that of other fish species, both in putrefying flesh and in predator diets. In addition, pre-emergence larvae (<10 days post hatch) may lack the sensory development to perceive and respond to these odorants. Since predator diet affects avoidance response of larvae, development of this behavior may be influenced by environmental factors such as community composition.

Corresponding Author: wassink3@msu.edu
Oral or Poster: Poster

Presenter: Willett, Naeem

Co-Authors:
Naeem Willett¹, Stephania Bolden², Dewayne Fox¹

¹ Delaware State University, 1200 North DuPont Highway, Dover Delaware 19901
² Protected Resources, NOAA Fisheries Southeast Regional Office, St. Petersburg, FL, 33701

Title: Where is the buffet? Monitoring Gulf sturgeon movement patterns as they enter the Gulf of Mexico to forage

Abstract: Due to population declines, Gulf Sturgeon (Acipenser oxyrhinchus desotoi) have been federally protected under the endangered species act since 1991. Gulf Sturgeon are an anadromous species that reside in rivers during the summer spawning periods fasting throughout their residence in the rivers. Adult and sub-adult Gulf sturgeon will migrate into coastal bays as well as the Gulf of Mexico to forage and replenish lost weight during summer fasting. Once Gulf Sturgeon enter the Florida Coastal waters of the Gulf of Mexico little information is known of foraging habitat and their activities within. Grasping an understanding of this behavior could play an important role in the long term management of this threatened species. In order to investigate fine scale movement patterns we deployed a high density VEMCO Positioning System (VPS) array of VR2W receivers (n=55) between October 14, 2014 and May 16, 2015. 41 Gulf Sturgeon accumulated >100,000 position estimates with Horizontal Position Error indicating 50% of the positions had a <12 meter estimated location range. Interpreting Gulf Sturgeon movement patterns in the Gulf of Mexico can play a key role in the long term sustainability and management of this Species. Interpreting and linkage between movement patterns and foraging activities can in turn reduce the negative impact of such things as habitat change as well as by-catch from the commercial fishing industry. Information provided by this study could give managers a better understanding of how and where these Gulf Sturgeon move while in near shore areas off the Florida Gulf coast.

Corresponding Author: nwillet45@gmail.com
Oral or Poster: Poster

Presenter: Wolf, Michael

Co-Authors:
Michael Wolf, Quinton Phelps, Nicholas Kramer, and Sara Tripp

Title: Clash of the planktivores: Interactions among Asian carp and paddlefish in the Mississippi River

Abstract: Asian carp (i.e., bighead carp *Hypophthalmichthys nobilis* and silver carp *Hypophthalmichthys molitrix*) are an r-selected, highly migratory planktivorous invasive species that are rapidly expanding their range throughout the Mississippi River basin. Purported detrimental interactions exist, as it relates to resource overlap, among native fishes and Asian carp in the Mississippi River basin. Of the many native fishes that could be negatively influenced by Asian carp; we hypothesize that paddlefish (*Polyodon spathula*), an obligate planktivore, will likely be one of the most sensitive species to the invasion. As such, the objective of our study was to investigate resource overlap of Asian carp and paddlefish in the Mississippi River. During 2013-2015 we conducted stratified-random sampling using hobbled 127-mm gillnets deployed in the upper, middle, and lower reaches of the Mississippi River. Regardless of river reach, Asian carp utilized similar locations to paddlefish indicating potential resource (e.g., food or space) overlap. Ultimately, our results suggest that potential negative interactions occur among Asian carp and paddlefish in the Mississippi River. We suggest future efforts should aim to control the Asian carp population (via commercial harvest) to reduce the negative impacts on paddlefish in the Mississippi River.

Corresponding Author: michael.wolf@mdc.mo.gov
Oral or Poster: Poster

Presenter: Young, Ryan

Co-Authors:
Ryan T. Young¹, Joseph R. Krieger¹, Edward F. Roseman², James S. Diana¹

¹University of Michigan, School of Natural Resources and Environment, 440 Church St. Ann Arbor, MI 48109-1041, US
²U.S. Geological Survey – Great Lakes Science Center 1451 Green Road Ann Arbor, MI 48105 US

Title: Assessing the spatiotemporal distribution of larval lake sturgeon within the St. Clair River delta, Michigan

Abstract: Recent research and management has recognized critical knowledge gaps relating to early life stages of lake sturgeon (*Acipenser fulvescens*) with focused need for understanding movement patterns and habitat use of the larval stage. To assess drift and movement patterns of larval lake sturgeon in the St. Clair River, we deployed a series of D-frame drift nets and depth-stratified conical net sets, which provided insight on their spatiotemporal distribution throughout the delta region (i.e. North and Middle Channels). From 2013-2014, catch-per-unit-effort (CPUE; No. larvae/hour), total length (TL; 0.1 mm), and developmental stage (i.e. full, partial, or no yolk sac) of larvae were quantified to assess changes in growth and catchability during larval drift. Significance of differences in CPUE and developmental stage were assessed using Kruskal-Wallis tests, followed by Dwass-Steel-Critchlow-Fligner post hoc procedure for pairwise comparisons, and TL was assessed using generalized linear model two-way analysis of variance, followed by Least Squares Means post hoc procedure for pairwise comparisons. Results showed larvae of variable growth stages to remain in the river in spite of strong currents, suggesting the nature of larval lake sturgeon drift is more active than passive, indicating upper riverine areas are used as nursery habitat or refuge and are important for their early survival. This information has broad implications when setting management priorities for lake sturgeon in large river systems, by identifying the interactions and attributes important for their early survival, which help managers consider feasible management options and implement the appropriate response.

Corresponding Author: ryyoung@umich.edu