2012 GREAT LAKES LAKE STURGEON COORDINATION MEETING

RAMADA PLAZA OJIBWAY HOTEL
240 W. PORTAGE AVE.
SAULT STE MARIE, MI 49783

Oral presentations

Day 1 - Monday, December 3, 2012

Estimating Lake Sturgeon Abundance and Other Parameters from Spawning Run Mark-Recapture Data

Edward Baker, Michigan Department of Natural Resources, Marquette, MI
Shirley Pledger, Victoria University of Wellington, Wellington New Zealand
Kim Scribner, Michigan State University, East Lansing, MI

Lake sturgeon population assessment in the Great Lakes remains a challenge due to low lake sturgeon abundance, sampling difficulties in expansive Great Lakes open water habitats, propensities for movements during prolonged inter-spawning intervals and the mixing of fish from different populations in Great Lakes waters. The best opportunity to sample lake sturgeon from a Great Lakes population is when the fish congregate in tributaries used for spawning. However, intermittent spawning complicates abundance estimation when capture-recapture sampling is possible. Temporary emigration models can be used when only a subset of the animals is present at any given sampling effort. However, most temporary emigration models require the use of the robust sampling design whereby secondary samples are collected, and their focus is usually on estimating probabilities of annual survival and transition between states (e.g. breeding and non-breeding). We have used our 11 year dataset of spawning run mark-recapture data from the Black River, MI to develop a novel likelihood-based temporary emigration model which yields plausible estimates of abundance, survival, transition and return time parameters and explicitly accounts for the intermittent spawning behavior of lake sturgeon. The new model also allows for model selection with information criteria (e.g. AIC). Our data reveal that abundance is overestimated if a Jolly-Seber type model is used with spawning run mark-recapture for lake sturgeon. We describe the utility of the new model under different sampling scenarios representing likely assessment options for managers.

Evaluating Harvest Regulations for Lake Sturgeon in the White Rapids Section of the Menominee River

Daniel Isermann, University of Wisconsin, Stevens Point, WI

Portions of the Menominee River that borders the states of Wisconsin and Michigan have supported recreational fisheries for lake sturgeon for decades. However, implementing harvest regulations that ensure the sustainability of these lake sturgeon stocks has been difficult. Our objective was to determine if population demographics and spawning potential ratios of lake sturgeon in the White Rapids section of the Menominee River vary under a range of different harvest regulations (e.g., minimum length limits, slot-length limits, harvest tags). We are currently using age-structured population models to assess population responses to the different regulations. Our goal is to provide

fishery managers with better information regarding the selection of harvest regulations for this and other lake sturgeon populations.

Lake Superior and Lake Huron Juvenile Lake Sturgeon Index Survey

Joshua Schloesser, U.S. Fish and Wildlife Service, Ashland, WI
Lloyd Mohr, Ontario Ministry of Natural Resources, Owen Sound, ON

In 2011 and 2012, juvenile lake sturgeon index surveys were developed for Lake Superior and Lake Huron, respectively, to meet assessment needs identified in rehabilitation plans. The objectives were to determine the status, index relative abundance, and describe the biological characteristics of lake sturgeon in Lake Superior and Lake Huron. Surveys were conducted at the river mouths of known historic and current spawning tributaries. Over 20 agencies and universities collaborated to implement these surveys during June-September each year. Biological data collected on lake sturgeon included length, weight, girth, an age sample, genetic sample, and all fish were given an external Floy and internal Passive Integrated Transponder (PIT) tag. Mean relative abundance (number per 1000 feet of net) on Lake Superior was 1.5 (range 0.0 - 6.5) lake sturgeon. Biological models, such as length frequencies, age class strength, quantile regression of length-weight, and von Bertalanffy growth will be compared among tributaries and lakes to assess population health. These were the first assessments in a long-term coordinated lake-wide effort to monitor recruitment, year class strength, and population trends over time.

Adult assessment – Are We Using Proper Gears?

Nancy Auer, Michigan Technological University, Houghton, MI

Brief discussion of some findings from summer 2012 in an effort to capture adult (large sturgeon) and the lack of success using the 8-10 inch gill netting suggested in survey protocol.

Demographic Factors and Male Behavioral Plasticity Affect Male and Female Reproduction Success and Temporal Variation in Effective Breeding Number in Lake Sturgeon

Kim Scribner[1], Yen Thuy Duong[1], James Crossman[1], Patrick Forsythe[1], Edward Baker[2]
[1]Department of Fisheries and Wildlife, Michigan State University, East Lansing, MI
[2]Michigan Department of Natural Resources, Marquette MI

Quantifying inter-annual variation in effective adult breeding number (N_b) and relationships between N_b, effective population size (N_e), adult census size (N) and population demographic characteristics are important to predict genetic changes in populations of conservation concern. Such relationships are rarely available for long-lived iteroparous species like lake sturgeon (*Acipenser fulvescens*). We estimated annual N_b and generational N_e using genotypes from 12 microsatellite loci for lake sturgeon adults (n=796) captured during 8 spawning seasons and offspring (n=3,925) collected during larval

dispersal in a closed population over 10 years. Inbreeding and variance N_b derived using multiple estimators were similar within and among years (inter-annual range of N_b: 41-205). Variance in reproductive success and unequal sex ratios reduced N_b relative to N on average 36.8% and 16.3%, respectively. Inter-annual variation in N_b/N ratios (0.27 - 0.86) resulted from stable N and low standardized variance in reproductive success due to high proportions of adults breeding and the species' polygamous mating system, despite a 40-fold difference in annual larval production across years (437 – 16,417). Results indicated environmental conditions and features of the species' reproductive ecology interact to affect demographic parameters and N_b/N. N_e may not be approximated as the product of average annual N_b and generation length (g). Therefore, supplemental breeding programs would be ill advised to divide the targeted N_e into a series of (g) annual target effective numbers (N_b). Results have important implications for genetic monitoring and conservation planning for lake sturgeon and other species with similar life histories and mating systems.

Spatially Explicit Analysis of Lake Sturgeon Egg Deposition and Mortality in Natural Stream Settings

Andrew Findley[1], Patrick Forsythe[2], Kim Scribner[2,3], James Crossman[3], and Edward Baker[4]
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Managers are interested in estimating recruitment in natural lake sturgeon populations and associations between features of the stream physical environment and egg abundance, distribution and loss. Understanding effects of ecological processes during critical life stages in structurally complex and spatially dynamic river systems necessitates use of spatial models that can account for spatial autocorrelation in dependent variables and environmental covariates.

Using data collected over multiple years and spawning sites on the Black River, MI, we apply novel Bayesian methods that incorporate parameters to account for spatial autocorrelated variables and anisotropic dependencies to estimate egg abundance and loss. Data on environmental covariates (water depth, water velocity, and substrate size) were collected at four spawning locations concurrent with surveys of egg deposition. Secondary sampling of eggs was conducted three days following the initial sample to quantify differences in egg number and live/dead status. A total of 9,426 eggs were collected across all spawning locations from 655 kick net samples. We found strong anisotropic patterns in spatial dependence in egg deposition and with parameter estimates associated with the stream covariates. The presence of residual spatial autocorrelation violates an assumption of the non-spatial models, leading to erroneous estimates of the regression coefficients associated with the stream covariates, inaccurate extrapolations of collection numbers to total deposition estimates, and incorrect prediction of rates of egg loss. Previous studies typically fail to account for spatial dependency in dependent variables (e.g., egg counts) and stream environmental variables, and thus results and applicability of findings to management are suspect.

How Diet and Collection Methods Affect the Mortality of Dispersed *Acipenser fulvescens* Larvae within a Streamside Rearing Facility

Philip D. Ganz[1], Nathan T. Barton[1], Kim T. Scribner[1], and Edward A. Baker[2]
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Hatcheries, including streamside facilities, have been widely used to moderate high mortality rates early in life for many fish species, including lake sturgeon. Lake sturgeon streamside rearing facilities obtain sturgeon through three modes: naturally produced eggs (NPE), direct gamete takes (DGT), and dispersing larvae (DL). Of these sources, DL are the most genetically diverse, making them a valuable resource for population rehabilitation. However, DL have the highest mortality within a streamside rearing facility, most of which occurs in the first two weeks following collection. We hypothesized that mortality could be attributed to one or both of two factors. Our first hypothesis was that DL have begun to feed exogenously before dispersing, develop a search image for wild food sources, and fail to transition to hatchery feed (*Artemia spp.*). Our second hypothesis was that high DL mortality could result from handling stress during capture (e.g., time in nets, water velocity, amount of debris in nets). We fed DL two diets: a standard hatchery diet of live *Artemia* nauplii only and live *Artemia* nauplii supplemented with filtrate from the natal river. Using a general linear model, we quantified the relative effects of hatchery diet and field variables with cumulative mortality over 14 days in the hatchery. DL fed *Artemia* and filtrate realized an 11% higher survival rate than DL fed only *Artemia*. We observed no significant influence of collection factors on mortality. Data suggest that dietary modification that includes naturally occurring organic matter can significantly increase DL survival within streamside hatcheries.

Ecological Conditions Experienced During Early Larval Stages Affect Larval Lake Sturgeon Phenotypes and Behavior

Kathleen Jay[1], Kim T. Scribner[1] and Jeanette McGuire[2]
[1]Department of Fisheries and Wildlife, Michigan State University, East Lansing, MI 48824
[2]Department of Zoology, Michigan State University, East Lansing, MI

Plasticity in expression of phenotypes and behaviors during early ontogenetic stages results from both genetic and environmental effects. Newly-hatched lake sturgeon (*Acipenser fulvescens*) larvae immediately burrow in substrate and exhibit considerable plasticity in timing of emergence. We quantified the effects of environmental conditions (food, predators, conspecific density), temperature, substrate, phenotype and family on the duration of time from hatch to emergence. Eggs (n=400) were incubated at 10°C or 18°C, and hatched larvae were placed into cups with substrate and maintained in ambient stream temperature and constant velocity. Time to emergence was recorded in days and cumulative temperature units. Significant ($p<0.01$) univariate predictors of emergence time included incubation temperature, growth, loss of yolk-sac, substrate, and degree of temperature deviance. Larvae emerged significantly earlier in treatments of high conspecific density and chemosensory predators cues. Models of best fit for emergence time included a three-way

interaction among incubation temperature, treatment, and degree of temperature deviance, as well as an additive effect of percent loss of yolk-sac. Collectively, data revealed physical and biotic conditions at the time of emergence and prior conditions during incubation affected emergence time. Plasticity in response to these conditions likely affects survival and recruitment at individual and population levels, respectively.

Phenotypic Responses to Anthropogenically Altered Environmental Regimes in Larval Lake Sturgeon (*Acipenser fulvescens*)

Kari Dammerman, Michigan State University, East Lansing, MI

Human disturbances have altered natural environments and disrupted selection regimes across all biological scales. Organisms likely respond to anthropogenic changes through modifications in genotypic composition and through phenotypic and/or behavioral plasticity. We predicted that larval phenotypes (body size) and behavior (timing of larval emergence) would vary among families in anthropogenically-modified habitats. Additionally, we predicted that the degree of developmental plasticity would be dictated by the environmental conditions experienced during each ontogenetic stage. Experiments were conducted using a well-studied population of lake sturgeon (*Acipenser fulvescens),* a long-lived exploited species of conservation concern in the Black River of Michigan. Fertilized eggs were incubated at spawning locations characterized by different thermal and flow regimes. To mimic dam-mediated flow conditions, fertilized eggs were also exposed to one of three flow treatments (high, low, and variable) within our stream-side facility. All individuals from both experiments were photographed at hatch, placed in individual incubation chambers within the facility, and photographed again at emergence to quantify larval traits including timing of transitions between ontogenetic stages. General linear mixed-models and known pedigree information were used to test for family, treatment, and family by treatment interactions for each trait. We found significant evidence for all three effects in traits in both experiments. The proportion of phenotypic variance attributed to genetic (family) effects (heritability) was estimated to range from 0.42-0.48. Our results indicate that individuals from different families differ in their response to environmental conditions demonstrating that anthropogenically-modified environments have the potential to alter population phenotypic distributions and genetic composition.

Day 2 - Tuesday, December 4, 2012

Streamside Rearing Facilities - Are we Meeting Biological and Cultural Objectives?

Marty Holtgren, Little River Band of Ottawa Indians, Manistee, MI

For 9 years the Little River Band of Ottawa Indians have operated a streamside rearing facility for lake sturgeon. To evaluate the effectiveness of the tribe's streamside rearing both biological and cultural criteria must be considered. This presentation will describe how biological and cultural goals were intertwined in the tribe's sturgeon stewardship plan and if these goals are being met.

First Nations Leading Lake Sturgeon Research in Ontario by Combining Traditional Knowledge with Scientific Research; A Case Study from Northeastern Lake Superior

Andrew Ecclestone, Anishinabek/Ontario Fisheries Resource Centre

The Anishinabek/Ontario Fisheries Resource Centre (A/OFRC) is a non-profit organization that works with member First Nations of the Union of Ontario Indians (UOI), in regards to fisheries assessment and management. We function as an independent source of information that is recognized and trusted by First Nations, governments, and other stakeholders. First Nations throughout Ontario have significant knowledge of and cultural ties to Lake Sturgeon, particularly those First Nations whose territorial boundaries border the Great Lakes basin. Of the 38 First Nations that make up the UOI, 25 border the Great Lakes basin (mainly Lake Huron and Lake Superior) and 4 border watersheds that support Lake Sturgeon populations. Since 1999, the A/OFRC has partnered with 12 of these First Nations to complete a total of 45 Lake Sturgeon research projects within the Great Lakes basin. These projects varied from spring spawning assessments, to open water netting, telemetry tagging and monitoring, critical habitat classification, and traditional ecological knowledge studies. In northeastern Lake Superior, the A/OFRC has worked in partnership with 3 First Nations, provincial and federal government agencies, and universities to gather traditional ecological knowledge and design scientific research projects that combine netting, radio telemetry, and habitat assessments on three spawning tributaries (Pic River, White River, and Michipicoten River). Results from these studies have identified and assessed critical habitat, estimated population abundance and characteristics, monitored movement patterns and environmental cues, and engaged communities in monitoring Lake Sturgeon populations within their traditional territories. Given the success of these projects, the A/OFRC believes that greater consultation and representation needs to be given to First Nations from government agencies to ensure that their views and knowledge are meaningfully incorporated into Lake Sturgeon decision making processes.

Sturgeon For Tomorrow: Our Journey With the Majestic Lake Sturgeon

Brenda Archambo, Sturgeon For Tomorrow, Cheboygan, MI

Commercial Fishers Connection to Lake Sturgeon

Tim Purdy, Purdy Fisheries, Sarnia, ON

Magnitude of Effect of Hydro-electric Operations on Lake Sturgeon Abundance in Ontario Rivers

Tim Haxton, Ontario Ministry of Natural Resources, Peterborough, ON

Dams and lake sturgeon have a long history, which has been extended within the last century to hydro-electric facilities. Given the migratory nature of lake sturgeon, dams generally have an adverse effect on their populations. These effects can be exacerbated at hydro-electric facilities as flows and

water levels are dramatically and frequently altered. Qualitatively, the effects of hydro-electric facility operations on lake sturgeon are generally known. However, despite the elongated history between the two, these effects have not been quantified (i.e., how much are lake sturgeon affected). The objective of this study was to ascertain the magnitude of effect (*d*) different hydro-electric facility operating regimes have on lake sturgeon abundance. Also, it was to quantify the effectiveness of remedial actions intended to offset these effects. A standardized index netting program was conducted throughout Ontario in unimpounded rivers and rivers managed as run-of-the-river, peaking and winter reservoir systems. Overall, 23 rivers were assessed in three Ministry of Natural Resources Administration Regions and a total of 362 lake sturgeon were sampled. The magnitude of effect of the hydro-electric facilities on lake sturgeon abundance was quantified as large (i.e., $d \geq 0.8$). Partitioned among water management regime types, this effect was lowest on run-of-the-river systems and greatest on both peaking and winter reservoir systems. Adults appear to be most affected in peaking systems whereas the magnitude of effect for juveniles was lowest in run-of-the-river systems. Despite the potential adverse effects of dams on lake sturgeon, only two hydro-electric facilities in Ontario have employed remedial actions to mitigate effects for this species. A spawning shoal was constructed downstream of Chenaux Generating Station on the Ottawa River in December 2008, however the effectiveness of this project would not yet be detectable at the time of this study. Flow augmentation during the spawning period was employed in the Kaministiquia River from 2004 – 2011. The magnitude of effect on the sturgeon population in that system was considerably less than observed for peaking systems suggesting that the management actions employed benefited lake sturgeon, specifically juveniles. However, this only represents one location. Additional mitigation and monitoring would be required to ascertain the true effectiveness of remedial actions for lake sturgeon on regulated rivers in the province.

Hydrokinetic Generation in the Great Lakes Basin

Paul T. Jacobson, Ph.D., Electric Power Research Institute, Glenelg, Maryland

Technologies are emerging to capture energy from unimpounded streams and rivers. EPRI has estimated that roughly 10 GWh_e/yr is technically recoverable by hydrokinetic technologies in the U.S. portion of the Great Lakes Basin, although an unknown portion of that is practically recoverable. Additional hydrokinetic resource exists in Canadian portions of the Great Lakes Basin. Hydrokinetic technology is relatively immature and diverse, and it is not yet clear which technologies will prove to be the most reliable, cost-effective, and environmentally sound. Environmental effects are expected to be relatively small compared to those of conventional hydropower; however, impacts will depend on system design, siting, and scale of project deployment. Prediction of project-level impacts is challenging because of the novelty of the technology, although useful tools and information are accruing. Mathematical modeling, laboratory studies, and field studies are all needed to predict and assess impacts, and progress is being made in each of these areas. Well-designed and well-implemented active adaptive management will be critically important to the permitting, licensing, and operation of hydrokinetic projects.

St. Claire River Hydrokinetic Proposal Update

Jim Boase, U.S. Fish and Wildlife Service, Waterford, MI

Blade Strike Survival and Hydrokinetic Turbine Passage: Results of Testing with White Sturgeon and Applicability to Other Species

Steve Amaral, Alden Research Laboratory, Inc., Holden, MA
Paul Jacobson, Ph.D., Electric Power Research Institute, Glenelg, MD

The installation and operation of hydrokinetic turbines in riverine habitats may impact local and migratory fish populations. One of the primary concerns associated with hydrokinetic projects is the potential for fish to be struck and injured or killed by turbine blades. With funding from the Electric Power Research Institute and the U.S. Department of Energy, we conducted laboratory evaluations of turbine blade strike mortality and fish entrainment through hydrokinetic turbines. The blade strike studies were conducted with trout and sturgeon and evaluated survival and injury for various fish lengths, blade leading edge thicknesses, and strike velocities. The resulting data set allows for blade strike mortality rates to be estimated for most teleost species and sturgeons for a wide range of turbine designs and operating conditions for both conventional hydro and hydrokinetic units. Flume testing with three hydrokinetic turbine designs provided survival and behavioral data for fish approaching and passing through the blade sweep of each unit. These tests include an evaluation of white sturgeon juveniles with an axial-flow ducted turbine. The results of these studies have produced valuable data that can be used to assess the potential for fish to be entrained and injured when encountering hydrokinetic turbines in the field.

The Effect of the Lampricides TFM and TFM/1% Niclosamide on Age-0 Lake Sturgeon

Lisa O'Conner, Department of Fisheries and Oceans – Canada, Sault Ste. Marie, ON

Between 2010 and 2011, 9 rivers tributary to Lakes Superior, Huron, and Michigan were treated with the lampricide TFM or TFM/ 1% niclosamide. 20 cages were distributed throughout the lampricide treated section of river containing age-0 lake sturgeon ranging in size from 25 – 120 mm. Lake sturgeon ranging in size from 35 – 120 mm survived the lampricide application. Total lake sturgeon survival ranged from 45 to 100%, with 89% of the rivers having 60% or better survival. Overall, lake sturgeon of smaller size than predicted by Boogaard et al (2006) survived in all 9 lampricide treatments.

Sea Lamprey Parasitism on Lake Sturgeon in Great Lakes

Henry Quinlan, Rob Elliott, Betsy Trometer, and Justin Chiotti, U.S. Fish and Wildlife Service
Tom Pratt and William Gardner, Department of Fisheries and Oceans
Mike Friday and Lloyd Mohr, Ontario Ministry of Natural Resources
Andrew Ecclestone, Anishinabek/Ontario Fisheries Resource Center

Fishery agencies across the Great Lakes have identified rehabilitation of lake sturgeon as an important component of stable, diverse fish communities. Despite ongoing efforts to rehabilitate lake sturgeon, Great Lakes populations were recently listed as threatened by the Province of Ontario and are being considered for listing by Canada's Department of Fisheries and Oceans. Sea lamprey, a non-native parasitic fish now prevalent in the Great Lakes are believed to influence lake sturgeon recovery through parasitism of sub-adult (ages 5-15) and adult (ages >15) lake sturgeon. We examined the prevalence and severity of sea lamprey marks on lake sturgeon populations from several locations in each basin throughout the Great Lakes. Our findings indicate that parasitism by sea lamprey on Great Lakes lake sturgeon is generally low. However, reporting of sea lamprey marks on lake sturgeon and utilization of the recently published dichotomous key for classification of sea lamprey marks on lake sturgeon is inconsistent. Expansion of the analysis to other key locations is necessary to develop a lake-wide perspective on the influence of sea lamprey attacks on lake sturgeon rehabilitation efforts.

LUNCH

Effects of Stocking on the Genetic Diversity of Lake Sturgeon

Amy Welsh, West Virginia University, Morgantown, WA

Our objective was to assess the genetic diversity of stocked lake sturgeon using neutral and adaptive genetic markers. Two stocked locations were studied: Oneida Lake, NY and the Menominee River, MI/WI. At Oneida Lake, two stocking scenarios were used: a single large-scale stocking from one source, and a multi-year stocking from a different source. Using twelve microsatellite loci, we evaluated whether stocking over multiple years increased the genetic diversity and effective population size of the resulting offspring. The resulting stocked population from multi-year stocking was less genetically different from the source population with similar levels of genetic diversity. However, the single-year stocking event had lower genetic diversity than its source population, resulting in those offspring being very different from their source population. Despite better genetic representation, the multi-year stocking program resulted in a very low effective population size, likely due to high variance in family sizes. At the Menominee River, stocked sturgeon were used to supplement an existing population. Using both neutral (microsatellite loci) and adaptive markers (MHC), rare alleles were not represented in the hatchery-produced offspring. Hatchery- and wild-produced offspring were genetically differentiated at neutral loci but did not differ at the adaptive loci, indicating that strong selection may eliminate genetic differences between hatchery and wild fish. Both studies show that stocking practices can reduce the genetic diversity of fish populations,

primarily by inadequate representation of alleles in the source population.

Lake Sturgeon Sampling Efforts in the Pennsylvania Waters of Lake Erie

Jeanette Schnars, Tom Ridge Environmental Center, Erie, PA

Historically, Lake Sturgeon (*Acipenser fulvescens*) have been known to inhabit Lake Erie along the shores of Erie County, Pennsylvania. Presently, there are few sightings annually many of which are not reported. This project has started an effort to routinely sample for Lake Sturgeon, determine optimal habitat through side-scan sonar, and create public awareness to formalize reporting. Sampling by baited set lines has been conducted during the 2011 and 2012 seasons in hopes of collecting fin clips for genetic analysis. Presently, no Lake Sturgeon have been caught. Side-scan sonar data was collected during the 2012 season to determine if optimal habitat still exists where Lake Sturgeon once spawned. Finally, outreach of the project through watch cards and posters has increased awareness to formalize live/dead Lake Sturgeon sightings along the Pennsylvania Lake Erie coastline. This two-year project has been funded by the Pennsylvania Coastal Zone Management program and efforts will continue through the 2013 season.

Using Concentrations of Metals in Pectoral Fin Rays to Track Movements and Improve Management of Lake Sturgeon Populations in the Great Lakes Basin

Jeffrey Ziegeweid, USGS Minnesota Water Science Center, Mounds View, MN

The complex, migratory life history of sturgeons complicates management and restoration efforts of lake sturgeon populations, and proposed Asian carp control barriers may further complicate sturgeon management efforts by prevent migration of sturgeon between critical habitats. Therefore, understanding the migratory patterns of lake sturgeon populations is essential to sustaining lake sturgeon populations. I propose to reconstruct the migratory history of individual sturgeon by using laser ablation inductively-coupled plasma mass spectrometry (LA ICP-MS) to relate concentrations of metals in annuli of pectoral fin rays to concentrations of metals from different water bodies. Strontium and barium have been used successfully to identify movements of other fish species between areas with distinct water chemistries, and manganese has been used to identify exposure of fish to hypoxic conditions. The LA ICP-MS method requires less time and money than traditional telemetry methods, and fin rays can be collected without invasive surgery procedures. Furthermore, the complete migratory history of an individual sturgeon can be obtained without sacrificing the fish. Several sturgeon management issues could be addressed, particularly the identification of critical nursery habitats and the timing of migrations between habitat types. The effectiveness of the LA ICP-MS method can be validated using telemetry data, and pectoral fin ray sampling could be incorporated into existing sturgeon sampling programs with minimal additional costs. The USGS has the laboratory capabilities to analyze water samples and fin ray cross-sections using ICP-MS technology. I am looking for interested collaborators with available pectoral fin rays, capture information, and possibly telemetry data.

New York Lake Sturgeon Recovery Program

Doug Carlson, NY Department of Environmental Conservation, Watertown, NY

Lake sturgeon has been among the charter members of New York's endangered or threatened species list, and there have been many gains for the species in 20 years. A stocking program began in 1993 with objectives of making the species not so narrowly confined to the large border waters of the state. Among the most significant gains are: 1) the border waters improving as places for lake sturgeon, 2) studies showing places and ways that sturgeon are doing well and 3) the favorable survival and growth of stocked sturgeon in the most depleted areas. A partnership between state, federal and academic organizations has been responsible for the steady progress and accumulation of information.

Lake Sturgeon Migration in the Detroit-St. Clair River System: Preliminary Results from an Acoustic Telemetry Study

Darryl Hondorp, U.S. Geological Survey, Ann Arbor, MI

Early in 2012, the Great Lakes Fishery Commission in conjunction with federal, state, and provincial partners initiated a study of the population spatial structure of lake sturgeon that spawn in the Detroit-St. Clair River system in order to provide much needed information on habitat use by different sturgeon populations as well as on population-scale movements and dispersal patterns at ecologically-relevant temporal scales. From April to early June 2012, spawning-condition adult lake sturgeon were captured in the Detroit R., lower St. Clair R., and upper St. Clair R., implanted with high-power acoustic tags with a battery life of 10 years, and then released near the capture site. Sturgeon movements between spawning, overwintering, and feeding grounds were then tracked using a network of strategically-located acoustic receivers. The goals of our presentation are 1) to communicate the goals, objectives, and expected results of this new project, and 2) to present preliminary results related to study objective #1, which was to determine whether dispersal of spawning-condition lake sturgeon in the Detroit and St. Clair rivers depends on release site.

Translocation and Telemetry of Pre-spawning Lake Sturgeon in an Upper Reach of the Menominee River

Jeremy Olach, Michigan Technological University, Houghton, MI

In spring of 2012, twelve pre-spawning sturgeon were tagged and translocated from one impounded each on the Menominee River to another impounded reach upstream. The sturgeon were implanted with Vemco transmitters and then tracked with both stationary and mobile receivers to determine whether they would travel upstream to use the historic spawning site at the top of the study reach. Within 8 days of translocation, seven of the twelve sturgeon were detected at the top of the 39 rkm study reach, where spawning activity was also observed. The study supports the idea that the impounded population of sturgeon dwelling downstream would utilize a historical spawning site after having no access to the site for over 60 years.

Adult Lake Sturgeon Movements on the Large Rivers of Green Bay, Lake Michigan

Micheal Donofrio, Wisconsin Department of Natural Resources, Peshtigo, WI
Kim Scribner, Department of Fisheries and Wildlife, Michigan State University, East Lansing, MI
Robert Elliott, U.S. Fish and Wildlife Service, Green Bay, WI
Edward Baker, Michigan Department of Natural Resources, Marquette, MI
Brian Sloss, Wisconsin Cooperative Fishery Research Unit, University of Wisconsin, Steven's Point, WI

Spawning river fidelity of lake sturgeon is difficult to assign considering the relatively long inter-spawning intervals and the complexity of conducting assessments on large water bodies 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.

Green Bay lake sturgeon have been genotyped (N=907) and indirectly assigned to assumed spawning river groups (Menominee, Peshtigo-Oconto, and Fox-Wolf); but direct tagging studies have indicated mixing of adult sturgeon between genetically assigned spawning rivers. Using acoustic telemetry, we observed the movements of adult lake sturgeon (N=83) into five Green Bay rivers (Cedar, Menominee, Peshtigo, Oconto, and Fox). Acoustic receivers allowed us to identify seasonal and directional movement patterns of these sturgeon for multiple years. We identified that most (57%) of the sturgeon tagged within or adjacent to the mouth of one of three rivers (Menominee, Peshtigo, and Oconto) were only detected in the river where they were originally tagged. However, it was common (19%) to detect implanted sturgeon in more than one river. No detections occurred with the Cedar and Fox river receivers, so we have no evidence that these sturgeon from the Menominee, Peshtigo and Oconto rivers used the former rivers.

A significant group (24%) of the lake sturgeon were not detected post-surgery which may be related to long inter-spawning intervals and a three year battery life of the original transmitters. We did not find any correlation between size or sex of the sturgeon as an explanation of movement. We are not able to confirm that upstream movements in April and May of each year was associated with spawning activity, since acoustic receivers were located downstream of known spawning sites. Movements were routinely detected during both spawning and non-spawning seasons; but most fish were only detected for a few days to weeks in the subject rivers and occupied the greater Green Bay waters for the remainder of the year. Genotypic assignments can corroborate that implanted fish originated from the rivers where they were tagged; but it appears from our acoustic telemetry data that mixing of these spawning stocks occurred during spring spawning periods.

Juvenile Stocked Lake Sturgeon Movements on Menominee River

Micheal Donofrio, Wisconsin Department of Natural Resources, Peshtigo, WI

The Menominee River is a boundary water between Michigan and Wisconsin. This river is known for its abundant lake sturgeon population and most populations have persisted despite the construction of several hydroelectric dams over the last nearly 100 years. Sustained, landlocked populations exist in the lower 50 miles of river but the section from Sturgeon Falls dam to Chalk Hills dam (20 miles) was recognized as an area where lake sturgeon have been extirpated. The Menominee river has been open to hook and line fishing since 1946 and the states have maintained a mandatory registration system since 1983. Anglers have not reported catching sturgeon in this section of the river. Wisconsin Department of Natural Resources has stocked juvenile lake sturgeon in the Menominee River for over 30 years in an attempt to restore an extirpated population. Despite the fact that over 90,000 fingerling and yearling sturgeon have been stocked in this river, periodic electrofishing surveys and spawning site observations have yielded relatively few sturgeon. Since the fin clips have been speculated to regenerate on lake sturgeon and these fish have not been entirely marked with PIT tags, the fate of stocked fish is unknown. It's believed these fish either don't survive after stocking, migrate downstream of this river section, or the stocking numbers have been too low to make a significant impact on the fishery.

In an attempt to determine the fate of stocked sturgeon, WDNR implanted 50 ultrasonic transmitters into two groups of stocked, juvenile lake sturgeon. These 50 fish were stocked on two events (summer and fall) with 950 other non-tagged lake sturgeon. Their downstream movement was monitored by multiple stationary receivers for several months. There was a significant difference in the movement patterns of these two groups. No sturgeon were detected leaving this section of the river. The conclusions of this study will impact the stocking strategy for this species.