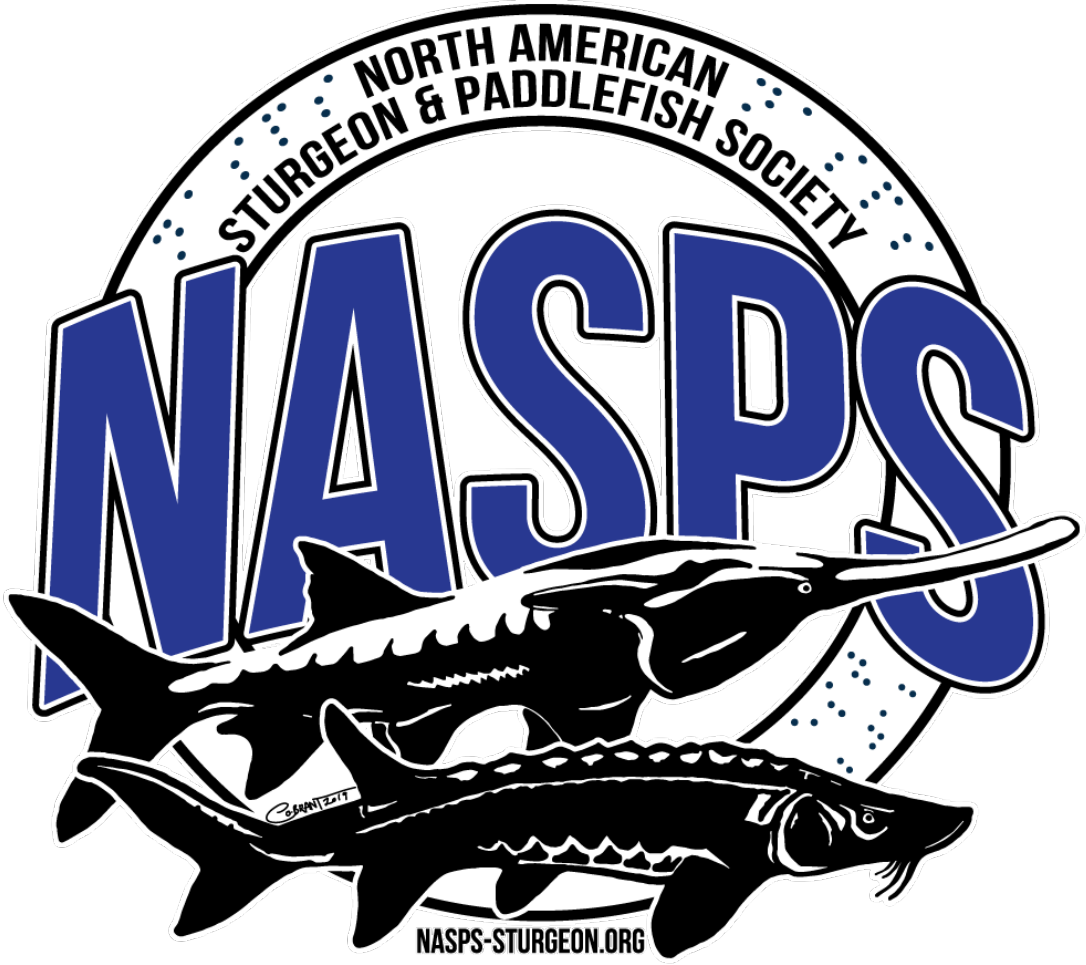
Abstracts for Oral Presentation
North American Sturgeon and Paddlefish Society 2025 Annual Meeting
Nelson, British Columbia
22-25 September 2025



Sterlet (*Acipenser ruthenus*) in the Austrian Danube - combining the latest knowledge on growth maturation and migration to improve management strategies

Thomas Friedrich, 2. Clemens Ratschan, 3. Jakob Neuburg, 4. Gerald Zauner, 5. Heidi Eichhorn, 6. Arne Ludwig & 7. Dietmar Lieckfeldt

University of Natural Resources and Life Sciences, Vienna (BOKU), 2 & 4 EZB-TB Zauner, 3 & 5 BOKU-University, 6 & 7 IZW-Berlin

The remnant populations of sterlet in Austria have lost a large part of their historic range and their migrations have been significantly hampered by hydropower dams in the last century. Data collected over more than ten years from various projects provide valuable new insights into the life history traits of sterlet, crucial for management practices like size limits and closed seasons, as well as stocking programs and the need for suitable fish passage facilities. The study area includes the Danube sections between the Jochenstein and Aschach hydropower plants on the Bavarian-Austrian border, and the free-flowing stretch downstream of Vienna to the Slovakian border.

Marine Movers and Shakers: Tracking Western Population Gulf Sturgeon

Michael J Andres[1], Paul O. Grammer[2], Kasea L. Price[1], Alyssa M. Pagel[1], Eugin Bornman[1], Mark S. Peterson[1], Michael A. Dance[3], Christian Walker[3], Kayla D. Kimmel[4], Ashley Baer[4], and Elizabeth M. Greenheck[5]

[1] Division of Coastal Sciences, The University of Southern Mississippi
[2] The Center for Fisheries, Research, and Development, The University of Southern Mississippi
[3] Department of Oceanography and Coastal Sciences, Louisiana State University
[4] Baton Rouge Fish and Wildlife Conservation Office, U.S. Fish and Wildlife Service
[5] Department of Environmental Science and Public Policy, George Mason University

Gulf Sturgeon (*Acipenser desotoi*) natal to the Pearl and Pascagoula rivers are generally referred to as the western population unit, despite no formal distinct population segment designation. Sturgeon natal to these systems have generally been defined by lower population estimates and higher mortality; however, recent work has shown juvenile survival to be similar. With the increased use of passive acoustic telemetry in the region, we have an opportunity to determine habitat use outside of federally designated critical habitat. We found Gulf Sturgeon from both the Pearl and Pascagoula rivers made winter foraging movements as far west as the Mississippi River Delta, along the Chandeleur Island chain, throughout Lake Pontchartrain, and throughout Mobile Bay to the east. The western extent of movements we have identified are still within their historical range but represent the most recent findings. Surprisingly, we have not found movements of western population Gulf Sturgeon east of Mobile Bay. The continued sharing of data through acoustic telemetry networks will help us stay informed on the presumed expansion of Gulf Sturgeon through their historical range.

Movement and activity of endangered Nechako River white sturgeon (*Acipenser transmontanus*) on the spawning grounds

Avery Dextrase, 2. Eduardo Martins, 3. Scott Hinch, 4. Melody Mah

University of Northern British Columbia, 2. University of Northern British Columbia, 3. University of British Columbia, 4. University of Northern British Columbia

Understanding of the movement and activity of white sturgeon (*Acipenser transmontanus*) on spawning grounds remains limited, particularly for the endangered Nechako River population, whose only known spawning habitat is confined to an approximately 3-km reach near Vanderhoof, British Columbia. In spring 2025, we monitored adult white sturgeon in this reach using radio telemetry to document movement and activity during the spawning period. As part of a broader study, 20 adult Nechako River white sturgeon (9 females, 11 males) were implanted with radio tags that transmitted depth, body temperature, and activity (overall dynamic body acceleration, ODBA) every 30 seconds. Tagged fish present on the spawning grounds were detected by four stationary receiver stations between early May and mid-June 2025. Ten tagged fish were detected, and based on sexual maturity assessments conducted at tagging, four detected fish were classified as likely spawners, four as possible spawners, and two as unlikely to spawn. The likely spawners first arrived at the spawning area between May 17th and May 25th and exhibited repeated entries and exits from the area. The fish were detected at all stations on multiple occasions, suggesting broad use of the spawning habitat. Residence time ranged from 66 to 185 hours. Mean depth experienced by the likely spawners was 1.7 m (SD: 0.5; range: 0–3.8 m), with all fish surfacing (0 m depth) at least once. Mean body temperature was 12.0°C (SD: 1.4; range: 6.8–19.2°C), and the spawners tended to have warmer body temperatures and occupy deeper water during the daytime and evening than in the night and early morning. Activity was highly variable, with a mean ODBA of 0.06g (SD: 0.08; range: 0–0.54g). This study provides novel detailed habitat use and movement data for spawning sturgeon on the Nechako River spawning grounds.

Reproductive structure of hatchery-origin white sturgeon in the Upper Columbia River

James A. Crossman[1], Molly A.H. Webb[2], and Jason G. McLellan[3]

[1]Fish and Aquatic Sciences, BC Hydro, Castlegar, British Columbia, Canada
[2]U.S. Fish and Wildlife Service, Bozeman Fish Technology Center, Bozeman, Montana, USA
[3]Confederated Tribes of the Colville Reservation, Spokane, Washington, USA

White sturgeon (*Acipenser transmontanus*) in the transboundary reach of the Upper Columbia River have low rates of natural recruitment, and the wild population has been supplemented with hatchery-origin fish annually since 2002. While releases of hatchery-origin sturgeon have prevented extirpation of the population, determining when the hatchery-origin segment reaches sexual maturity is critical to describing changes to numbers of mature spawners after decades of recruitment bottlenecks. To assign sex and stage of maturity of hatchery-origin sturgeon, gonad biopsies and blood plasma were collected from fish throughout habitats in Canada and the US from 2015-2024. Sex and stage of maturity was assigned using histological analysis of the gonad tissue, and steroid concentrations for estradiol and testosterone were paired with histology to develop less invasive indicators of sex-specific reproductive status. We compared size at maturation for hatchery-origin and wild sturgeon and incorporated information from adjacent white sturgeon populations. Females have not progressed past the pre-vitellogenic stage, with the oldest females assessed being 23 years of age. Females are just reaching a size (>160.0 cm) where they may reach puberty based on other populations. A portion of males have reached maturity (mean age of 12.3 years (range 8.3 – 16.4), mean fork length of 138.4 cm (range 89.5-161.0), and mean weight of 21.5 kg (range 4.9 – 36.1)). Fifty percent of males were mature at a size of 149.3 cm fork length (144.7 – 156.2, 95% CI). Reproductive males are distributed across multiple year classes and families in both countries, with more reproductive males in the US. Testosterone was a significant predictor of reproductive status for males, with 40 ng/L (34.7-47.8 95% CI) representing a threshold where 50% of males were reproductive. Describing rates of maturation of hatchery-origin fish is critical to understanding the effectiveness of conservation aquaculture in achieving population recovery.

Reproductive Structure of Hatchery-origin Pallid Sturgeon above Fort Peck Dam

Luke Holmquist[2], Molly Webb[1], James Crossman[3]

[1]USFWS Bozeman Fish Technology Center, [2]Montana Department of Fish, Wildlife and Parks, [3] BC Hydro

Hatchery-origin pallid sturgeon (*Scaphirhynchus albus)* have been stocked into the upper Missouri River above Fort Peck Dam since the late 1990s in response to a lack of natural recruitment. Understanding when the hatchery-origin fish within the population reaches sexual maturity is critical to understanding the effectiveness of the program in recovering this federally endangered species. Using combined historical and contemporary data (n=752; 2011-2024), we described sex-specific relationships between age and size at first maturity and spawning periodicity and evaluated false maturation rates in female pallid sturgeon. Males are reaching sexual maturity at a smaller size and younger age than females. Males are physiologically capable of annual spawning, but not all males spawned every year. Females are physiologically capable of spawning every two years, but the spawning periodicity ranged from two to five years once sexual maturity was attained. False maturation occurred during the first reproductive cycle as females initiated but failed to complete vitellogenesis, and mass follicular atresia was found to occur in some subsequent cycles. The rate of false maturation was compared to the rate of mass follicular atresia occurring in females that had spawned previously. Understanding fish reproductive biology is essential for successful management and conservation of this species.

Moving Towards Growth: Translocation as a Tool to Improve Growth and Condition in Slow-Growing White Sturgeon

Joe Rector

Idaho Power Company

The reach between Hells Canyon and Lower Granite Dams is home to one of two remaining naturally reproducing White Sturgeon populations in the Snake River and is of great conservation priority. Historic and contemporary observations of poor condition, extremely poor growth, and strong site fidelity among juvenile-sized White Sturgeon in the riverine portion of this reach raised concerns of a growth bottleneck, delayed maturation, and potential for negative population level impacts. This, combined with relatively strong annual growth increments (AGIs) and good condition observed in resident individuals in Lower Granite Reservoir, sparked a 2021-2023 multi-agency collaborative translocation pilot program in which juvenile-sized fish (<95 cm fork length, FL) were captured and moved from riverine habitats to the reservoir in an effort to overcome the upstream growth bottleneck. Subsequent incidental recaptures during recruitment assessments and population surveys have since shown that translocated fish are exhibiting exceptional growth rates and excellent condition, significantly exceeding previously observed AGIs, including those of similar-sized known age reservoir resident juvenile fish. These fish are on track to reach reproductive size decades ahead of their upriver counterparts, though their future reproductive potential remains to be seen and there are concerns of fish leaving the reach via entrainment past Lower Granite Dam. Additionally, there has yet to be an observed growth response in upstream, non-translocated fish, suggesting that a growth bottleneck still exists. In this system, translocating juvenile-sized individuals from the river to the reservoir appears to be an effective method for increasing growth and overall fish condition and may be a viable strategy to mitigate demographic declines and reduced spawning potential associated with poor juvenile growth.

35,000 kg of Lake Sturgeon in a 9.8 km reservoir = carrying capacity

Craig McDougall, Patrick Nelson, Laura Henderson

North/South Consultants Inc., Winnipeg, MB

Carrying capacity for Lake Sturgeon is an elusive concept, which complicates the approach to species recovery efforts. Intensive environmental monitoring by Manitoba Hydro in relation to the Pointe du Bois Generating Station Spillway Replacement Project on the Winnipeg River led to the collection of a huge quantity of Lake Sturgeon data between 2006 and 2021. We synthesized all available data from the Slave Falls Reservoir, including Manitoba Fisheries Branch tagging data from 1991 – 2003, in an effort to understand the rise of density dependence in the reservoir. Following invocation of the Winnipeg River Conservation Closure in 1994, the Slave Falls Reservoir population recovered rapidly. By 2006, ~35,000 kg of Lake Sturgeon was present in the reservoir. Growth moderation (including individuals literally shrinking in terms of both length and weight), depressed survival/retention within the reservoir, and cohort suppression have all occurred since 2006. Slight increases in Lake Sturgeon biomass evident between 2006 and 2020 likely have come at the expense of the fish community.

Endangered fishes in an ultra-urbanized landscape: patterns of shortnose occupancy in New York Harbor

Shannon White, 2. Amanda Higgs, 3. Dewayne Fox

USGS, 2. Department of Natural Resources and the Environment, Cornell University, in cooperation with New York State Department of Environmental Conservation, New Paltz, NY, USA , 3. Delaware State University, Department of Agriculture and Natural Resources, Dover, Delaware, USA

Industrialization has fundamentally altered the structure and function of contemporary landscapes. For many species, legacy effects of anthropogenic disturbances have amassed to large-scale shifts in distribution and ethology that are observed in present-day populations. In highly disturbed environments, persistent interactions with human activities may also continue to present a cryptic catalyst for demographic decline. Here, we seek to understand the spatiotemporal significance of one of the most urbanized landscapes in the world — New York Harbor, USA —for endangered shortnose sturgeon. Using acoustic telemetry, we show that New York Harbor supports a unique behavioral phenotype of shortnose sturgeon that spend significant time in the harbor in late spring and fall, likely using the habitat to optimize bioenergetic processes. This study suggests that New York Harbor is a uniquely important habitat that maintains species and functional diversity of the Hudson River ecosystem. Failure to recognize the eco-evolutionary significance of New York Harbor in conservation planning could result in unintentional loss to long-term population resiliency and turn this habitat into an ecological trap.

Documenting carcass decay to inform estimates of post-mortem interval and analysis of tissue metal levels in white sturgeon (*Acipenser transmontanus*)

Steven McAdam, Rachael MacKinnon, Angie Coulter

BC Ministry of Water, Land and Resources Stewardship

Episodic mortalities of sturgeon lead to broad concern due to the endangered status of many species and uncertainty about the potential causes of mortality. Estimating the post-mortem interval (PMI) is a key piece of information for evaluating causation, yet standardized indicators for estimating PMI are not available for sturgeon and are generally rare for fish. We monitored the progression of carcass decay over a 14-day period to document daily changes in carcass condition. Tissue metal concentrations in muscle and liver were evaluated after 0, 7 and 14 days post-mortem. Carcasses were generally negatively buoyant until 6 days post-mortem, after which they were consistently positively buoyant. Visual changes provided useful milestones to estimate PMI based on the continued loss of red coloration in the gills followed by a progression to grey and black, increasing opacity of the eyes, as well as characteristic drying and color changes in the skin at various times post-mortem. Metals analysis identified limited changes in samples taken after 7 days, but increased error after 14 days. Comparison with previous estimates of PMI suggests that non-standardized estimates tend to underestimate the PMI.

Should I Stay or Should I Go? Investigating the environmental parameters impacting Gulf Sturgeon, *Acipenser desotoi's*, spawning-related movement in anthropogenically mined formations of the Bouie River System.

Olivia St. Germain, 2. Kasea Price, 3. Paul Grammer, 4. Michael Andres

University of Southern Mississippi, 2. Gulf Coast Research Laboratory, 3. Gulf Coast Research Laboratory, 4. University of Southern Mississippi

The anadromous Gulf Sturgeon (*Acipenser desotoi*) is listed as federally "threatened" and has seven natal rivers from Louisiana to Florida. Populations natal to the Pearl and Pascagoula rivers (referred to as western populations) appear have recovery rates that are stagnating behind their eastern counterparts. Only one spawning reach was verified by egg and larvae collection, a modified reach of the Bouie River- an upper tributary of the Pascagoula River. Downstream reaches of the Bouie River are characterized by 5 large anthropogenically mined formations, hereafter referred to as pits, ranging from 6-18 meters in depth. The greater depths associated with this area have prompted previous researchers to suggest Gulf Sturgeon may over-summer in these formations. We implemented a generalized mixed linear model that revealed that an increase in water temperature and air pressure, coupled with a decrease in lagged water discharge rate, was associated with departure from the Bouie River. Preliminary investigations found that sturgeon had varying occupancy rates in the pits, including some that resided there until late fall instead of migrating to downstream summer resting areas in the lower Pascagoula River. Extended summer residency mirrors summer resting behavior in downstream presumed energetic refuges. Summer thermal regimes and stratification events might expose this vulnerable population to additional environmental stressors. During summer, stratification occurs in the lower pits and decrease in stream flows, with differences between surface and bottom temperatures of up to 13 °C. Bottom temperatures associated with the pits are lower than those near summer resting habitats at rkm 50. However, the potential for low dissolved oxygen in pit bottom water warrants further research to determine the suitability of resting habitat for spawning individuals. This research enhances our understanding of the environmental pressures affecting the Pascagoula River sturgeon population and may help inform restoration of the lower Bouie River.

Beyond presence-absence: Using accelerometer transmitters to infer post-restoration activity and residency of Gulf Sturgeon (*Acipenser desotoi*) at Ship Island, Mississippi

Morgan Segrest, 2. Peterson MS, 3. Slack WT, 4. Grammer PO, 5. Wilber D, 6. Bornman E, 7. Andres MJ

Division of Coastal Sciences, School of Ocean Science and Engineering, The University of Southern Mississippi, Ocean Springs, Mississippi, USA. 2. Division of Coastal Sciences, School of Ocean Science and Engineering, The University of Southern Mississippi, Ocean Springs, Mississippi, USA, 3. U.S. Army Engineer Research and Development Center, Environmental Laboratory EEA, Vicksburg, Mississippi, USA, 4. Center for Fisheries Research and Development, The University of Southern Mississippi, Ocean Springs, Mississippi, USA, 5. Bowhead, Charleston, South Carolina, USA, 6. Division of Coastal Sciences, School of Ocean Science and Engineering, The University of Southern Mississippi, Ocean Springs, Mississippi, USA, 7. Division of Coastal Sciences, School of Ocean Science and Engineering, The University of Southern Mississippi, Ocean Springs, Mississippi, USA

Gulf Sturgeon (GS; *Acipenser desotoi*) are an anadromous species that make foraging runs to saline waters during winter wherein they feed on benthic infauna. The waters around Ship Island, MS, located within GS federally designated critical habitat and part of the Mississippi barrier island chain, is a known foraging area for GS from multiple populations. Between 2017—2020, Ship Island underwent major restoration wherein a 3.5-mile breach in the island was filled with dredge material. Gulf Sturgeon use of the area pre- and post-restoration was monitored using an acoustic telemetry array. Post-restoration monitoring included using accelerometer (m/s2; activity index - AI) transmitters to determine if they could provide insights into GS behavioral patterns (e.g., foraging) beyond the conventional presence-absence data used in telemetry studies. A total of 43 GS (17 and 27 from the Pearl River and Pascagoula River, respectively) were implanted with Innovasea V16AT transmitters from 2021—2024. During the winter months of 2021—2025, 35 GS were detected by receivers (69 total) divided into four monitoring zones, corresponding with two island passes and the north and south island faces. We hypothesized that AI in a given zone inversely relates to higher infaunal biomass and that residency duration would be lowest in such zones. We found GS reside in one island pass and the protected (northern) face of the island over the other two zones, but that pooled infaunal biomass did not differ meaningfully across zones. A linear mixed-effects model found a weak positive correlation between residency time and AI in each zone, indicating that longer stays were slightly associated with an increased AI. However, neither residency duration, zone, or infaunal biomass had a statistically significant effect on AIs. Direct observation of GS in controlled settings is needed to further understand AI values.

Upper Columbia River White Sturgeon Recovery: Lessons from 24 years of conservation aquaculture

Michael Keehn[1], James A. Crossman[2], Chad Fritz[1], and Jason G. McLellan[3]

[1]Freshwater Fisheries Society of BC, 4522 Fenwick Rd Fort Steele, BC V0B 1N0, Canada,
[2]Fish and Aquatic Sciences, BC Hydro, 601 18th Street, Castlegar, BC, V1N 2N1, Canada
[3]Confederated Tribes of the Colville Reservation, Spokane, WA, USA.

While conservation aquaculture has become a critical component of recovery programs for sturgeon species worldwide, many programs were initiated in the absence of information needed to inform critical decisions regarding numbers of progeny released, their sizes and ages, and how to maximize genetic diversity. For approximately the last 40 years, recruitment of White Sturgeon (*Acipenser transmontanus*) in the Transboundary Reach of the Columbia River has not occurred at a rate sufficient to maintain the population. Accordingly, the population has been the focus of intensive recovery efforts undertaken in both Canada and the United States under a coordinated recovery initiative that includes multiple entities including regulatory agencies, industry, first nations, and stake holders. Conservation aquaculture has been the main recovery measure under the initiative in order to meet two objectives, i) prevent extirpation until natural recruitment can be restored by rebuilding the natural age class structure, and ii) preserve the wild genetic variability of the existing wild population. While releases of hatchery-origin progeny has largely resulted in extirpation being avoided, it has not come without challenges and continual refinement. We present an overview of how the conservation aquaculture program was adaptively managed in response to new information over 24 years, describe changes in methods to produce progeny for release, and highlight both successes and unanticipated outcomes from post-release monitoring. Lessons from recovery of Upper Columbia White Sturgeon can be used to improve practices to increase post-stocking survival and genetic diversity but should also be seen as a cautionary tale to recovery programs either in their infancy or that lack adequate post-release monitoring results.

Systems Approaches to Sustainable Sturgeon Aquaculture: Research and Extension Priorities from the UC Davis Program

Jackson Gross

UC Davis, Cooperative Extension in Aquaculture

The UC Davis Aquaculture Extension Program is addressing key sustainability challenges facing sturgeon aquaculture in North America through a systems-based research and outreach portfolio. This presentation summarizes a multi-year effort to develop, evaluate, and implement practices that improve biological performance, economic viability, and animal welfare across the sturgeon production lifecycle. Our program integrates research in reproductive efficiency, nutrition, humane slaughter, and knowledge transfer, with the goal of building a science-based foundation for long-term industry resilience. We are advancing tools for non-invasive sex determination and spawning management to reduce the time, labor, and resource intensity of broodstock production. Concurrently, we are evaluating alternative feed strategies that replace marine-derived proteins with regionally available agricultural byproducts to reduce feed costs and environmental impact without sacrificing product quality or animal health. A central component of our work focuses on humane slaughter practices. We are investigating multiple approaches—including captive bolt, electrical stunning, and neurophysiological assessment of brain function—to establish species-specific indicators of sensibility and welfare. These efforts aim to support the development of certifiable slaughter protocols aligned with evolving regulatory and consumer expectations.

Our extension activities ensure that research outcomes are rapidly transferred to producers, agencies, through on-farm demonstrations, training workshops, and technical advising. By actively involving stakeholders in the research process, we are creating scalable, adaptable solutions that address both current production constraints and future sustainability demands. Together, these efforts reflect a cohesive vision for advancing sustainable sturgeon aquaculture—one that integrates scientific rigor with practical application, ethical responsibility, and long-term ecological and economic resilience.

Nechako White Sturgeon Conservation Fish Culture Program

Mike Manky, Kara Geary
Freshwater Fisheries Society of BC

The Nechako White Sturgeon Conservation Centre (NWSCC), established in 2014 by the Freshwater Fisheries Society of BC, is a specialized facility dedicated to the recovery of Nechako White Sturgeon. At its core is a Recirculating Aquaculture System (RAS), which supports year-round rearing under controlled conditions. In addition to fish culture, the NWSCC functions as a regional hub for white sturgeon recovery efforts, including habitat restoration, scientific research, and public outreach.

Recovery strategies at the NWSCC are adaptively managed by the Province of British Columbia, with guidance from the Nechako White Sturgeon Recovery Initiative (NWSRI) Technical Working Group (TWG). The current approach includes the annual release of approximately 300 two-year-old juvenile sturgeon at multiple sites across the Nechako River Watershed. Additionally, 30 one-year-old juveniles are released annually to help identify and monitor ecological bottlenecks impacting recruitment success.

A core priority of the program is maintaining genetic diversity. Wild broodstock—up to 20 adults per year—are captured and spawned on-site, with fertilized eggs incubated in up to 96 separate containers to maintain distinct family groups. Eggs collected from natural spawning events in the river are also incorporated to enhance genetic representation. Larvae and juveniles are reared in custom-sized tanks that allow for genetic separation until individual tagging.
The RAS technology provides several key benefits for conservation aquaculture, including precise temperature control, high water quality, and efficient use of resources. Together, these features support the production of genetically diverse, healthy juveniles that contribute to long-term species recovery efforts in the Nechako River.

Observed prevalence and potential reduction of Spontaneous Autopolyploidy in a hatchery supported White Sturgeon population.

Troy Smith, 2. Mark Elliston, 3. Brian Michaels, 4. Marley Bassett, 5. Ryan Sylvester, 6. Jim Dunnigan, 7. Nate Jensen, 8. Sean Wilson

Idaho Department of Fish and Game, 2. Kootenai Tribe of Idaho, 3. Kootenai Tribe of Idaho, 4. British Columbia Ministry of Water, Land, and Resource Stewardship. 5. Montana Fish, Wildlife, and Parks, 6. Montana Fish, Wildlife, and Parks. 7. Kootenai Tribe of Idaho, 8. Idaho Department of Fish and Game

Spontaneous Autopolyploidy (SA) in hatchery reared sturgeon has been a concern for conservation aquaculture programs supporting endangered or threatened populations. SA individuals are demographic dead-ends and can limit population growth. The Kootenai Tribe of Idaho has operated a conservation aquaculture program on the Kootenai River since 1989. Prior to 2012, no testing or mitigation occurred for hatchery released individuals. Since then, hatchery management and practices have resulted in 0-3% SA prevalence being released annually. We captured 324 hatchery origin White Sturgeon *Acipenser transmontanus* in the Kootenai/y system from 2023-2024 and blood tested for ploidy via Coulter Counter. Of the 324 fish tested, only 10 (3%) were SA across all year classes. No SA individuals were detected in fish greater than 15 years old. Previous estimates using blood smear technique estimated an at-large prevalence of 9% in the population. Our results were unexpected given that the prevalence of SA individuals released in years classes prior to 2012 were likely much higher than the current mitigation. Diminished presence of SA individuals over time may indicate that there is some selection against SA in the wild.

Development of green sturgeon reference genomes to identify regions associated with sex

Andrea Schreier, 2. Emily Funk, 3. Nann Fangue, 4. Daphne Gille

University of California Davis, 2. University of California Davis, 3. University of California Davis, 4. California Department of Water Resources

Advances in long-read DNA sequencing technology now allow us to sequence and assemble the large, highly duplicated genomes of ploidy group B and C sturgeons. I will provide an update on a collaborative effort between UC Davis and the California Department of Water Resources to develop male and female green sturgeon (*Acipenser medirostris*) reference genomes to identify regions associated with sex to better understand sex-specific habitat use in the Sacramento-San Joaquin Delta. Long-read genomes have been assembled for both a male and female northern DPS green sturgeon broodstock, housed at UC Davis and generously donated by the Yurok Tribe for research to enhance conservation efforts. The female green sturgeon genome has been scaffolded using the Proximo pipeline and contains 216 superscaffolds, likely analogous to chromosomes, and 100% of essential vertebrate gene content. Nearly all (96%) genes are present in a duplicated state in this individual, a larger proportion than was reported for the ploidy group A sterlet (70%; A. ruthenus). At the time of abstract submission, scaffolding of the male genome is underway and I will present results of comparative genomic analyses performed to identify putative sex associated regions in the green sturgeon genome.

Cenozoic origin of the mis-named lake sturgeon in the Paleo-Bell River

Chris Wilson, 2. Tim Haxton

Ontario Ministry of natural Resources, 2. Trent University

The common name for lake sturgeon (*Acipenser fulvescens*) is somewhat misleading. Although the species' history and decline is documented in particular detail in the Laurentian Great Lakes, it is primarily a riverine species with a long evolutionary legacy of adaptation to fluvial conditions. Based on geological and molecular data, we argue that lake sturgeon evolved in the Paleo-Bell River during the early to mid-Cenozoic Era (Eocene to Oligocene Epochs). The size and extent of the Bell River would have facilitated the adaptation of lake sturgeon to a strictly freshwater existence, especially after the disappearance of the Cannonball Sea in central North America approximately 59 million years ago. Other facets of the species' ecology, such as its long generation time, iteroparous reproductive strategy, dependence on large stretches of continuous riverine habitat, and use of deltaic habitats by juveniles, likely reflect its evolutionary origins and adaptation to this ancient river system. Ironically, some of the most intact contemporary populations of lake sturgeon occur in former tributaries of the Bell River system, and which have re-emerged following retreat of the Laurentide Ice Sheet at the end of the Pleistocene. The ecological attributes of lake sturgeon which made the species superbly adapted to the ancient Bell River system now make the species uniquely vulnerable to habitat fragmentation and loss, as well as anthropogenic stressors such as overexploitation.

An updated estimate of population size for Hudson River shortnose sturgeon

Amanda Higgs, 1. Shannon White, 2. John Madsen, 3. Dave Kazyak, 4. Dewayne Fox, 5. Richard Pendleton, 6. Adam Bonemery, 7. Tomasz Smolinski, 8. Amanda Simmonds, 9. Patrick Sullivan

New York State Department of Environmental Conservation/ Cornell University DNRE Division of Marine Resources/Hudson River Fisheries Unit,

1. U.S. Geological Survey Eastern Ecological Science Center, Kearneysville, WV, USA
2 University of Delaware, Department of Earth Sciences, Newark, DE, USA
3. U.S. Geological Survey Eastern Ecological Science Center, Kearneysville, WV, USA
4 Delaware State University, Department of Agriculture and Natural Resources, Dover, Delaware, USA
5 Department of Natural Resources and the Environment, Cornell University, in cooperation with New York State Department of Environmental Conservation, New Paltz, NY, USA
6. Division of Marine Resources, New York State Department of Environmental Conservation, NY, USA
7. Delaware State University, Division of Physics, Engineering, Mathematics, and Computer Science, Dover, Delaware, USA
8. Division of Marine Resources, New York State Department of Environmental Conservation, NY, USA
9. Cornell University, Department of Natural Resources and the Environment, Ithaca, NY, USA

Shortnose sturgeon (*Acipenser brevirostrum*) was among the first fish species to be afforded federal protection and is currently listed as endangered under the United States Endangered Species Act. Abundance estimates have not been completed for many shortnose sturgeon populations in over a decade largely owing to difficulties in using traditional methods to estimate abundance. Using a Bayesian hierarchical framework, we combined acoustic telemetry and side-scan sonar demonstrating abundance of shortnose sturgeon in the Hudson River, New York has likely increased in recent decades. Our study highlights that shortnose sturgeon in the Hudson River may be particularly vulnerable to disturbances that occur at temporal and spatial scales, as over half of the population congregated in a discrete overwintering habitat that is subject to significant anthropogenic activity. Therefore, while the population size of Hudson River shortnose sturgeon appears to be stable, possibly increasing, additional study may be warranted to better identify and mitigate contemporary threats to long-term population persistence. Moreover, although our results are encouraging for recovery of Hudson River shortnose sturgeon, all shortnose sturgeon populations are listed concomitantly under the Endangered Species Act. Therefore, assessment of range-wide population status and vulnerability may be needed before changes in federal protection are considered.

Identifying Threats and Opportunities Posed to Larval and Juvenile Sturgeon by Protective Fish Screens

Anna Steel, 2. Duoli Yang, 3. Alison Gallet, 4. Brock Peterson, 5. Leanne Pearl, 6. Kara Carr, 7. Dennis E. Cocherell, 8. Levant Kavvas, 9. Nann A. Fangue

University of California, Davis, 2. Department of Wildlife Fish and Conservation Biology, University of California, Davis, USA, 3. Department of Wildlife Fish and Conservation Biology, University of California, Davis, USA, 4. Department of Wildlife Fish and Conservation Biology, University of California, Davis, USA, 5. Department of Wildlife Fish and Conservation Biology, University of California, Davis, USA, 6. Department of Civil and Environmental Engineering, University of California, Davis, USA, 7. Department of Wildlife Fish and Conservation Biology, University of California, Davis, USA, 8. Department of Civil and Environmental Engineering, University of California, Davis, USA, 9. Department of Wildlife Fish and Conservation Biology, University of California, Davis, USA

Fish screens are commonly installed at water diversions to prevent direct entrainment of fishes. Current criteria for fish screens in North America were developed based on salmonids, and may inadequately protect fish with weaker swimming performance, such as sturgeon. Larval sturgeon often rear in large rivers where they are exposed to water diversions, while downstream migrating juveniles may pass multiple diversion points while still at a small body size. Here we evaluated the interactions of larval and juvenile green sturgeon (*Acipenser medirostris*) with a vertical-slot flat-plate fish screen (50% open area, 1.75mm bar spacing) at varying operational flow velocities. We conducted the study within a large annular flume (6.1m diameter) equipped with a model fish screen designed to create continuous screen exposure conditions. To identify opportunities to improve protectiveness, the study examined lethal and sublethal effects of exposure across developmental stages and under varying flow conditions. Results indicate there is a period of high vulnerability for larvae (25 – 45mm fork length), where faster water velocities result in increased mortality. Yet when fish exceeded 60mm in length they experienced near-zero mortality at all tested water velocities. Behavioral and physiological responses, such as distance from screen and cortisol levels, suggested that sublethal effects also varied by flow conditions and fish size. This study demonstrated that current salmonid-based screening criteria may be insufficient for protecting larval green sturgeon under 50mm in length, yet shows promise for juvenile life stages. Further work may test the role of substrate roughness in mediating screen-related mortality. These findings underscore the need for the development of screening criteria tailored to native fish with weaker swimming capacity to ensure more effective conservation of fish communities and to mitigate the risk of fish loss associated with water diversions.

In River Juvenile (Age 1) Telemetry of Kootenay White Sturgeon

Marley Bassett, 2. Aaron McGregor, 3. Sarah Stephenson, 4. Sean Wilson, 5. Troy Smith

BC Ministry of Water, Land and Resource Stewardship, 2. BC Ministry of Water, Land and Resource Stewardship, 3. BC Ministry of Water, Land and Resource Stewardship, 4. Idaho Fish and Game, 5. Idaho Fish and Game

Kootenay White Sturgeon (*Acipenser transmontanus*) is an endangered, transboundary population that relies on hatchery supplementation as a conservation strategy. Understanding dispersal and survival of released hatchery-reared juveniles is key to inform population estimates and release strategies given the low growth and high juvenile densities observed in the river portion in the Kootenay population. Sufficient data for movement exists for age 4+ fish via mark recapture studies but data gaps exist for juveniles at release until age 4. The last time age 1 fish were tagged and monitored was in 2009 and this study re-evaluates these findings. This study used passive telemetry to track age-1 sturgeon post release to evaluate movement, survival, and habitat preferences. A total of 71 juveniles (10 months old) were surgically implanted with V8 acoustic tags (405-day battery life) and released at two locations in the river: one upstream near the Montana–Idaho border, and another 100 km downstream at the Canada–US border, which is roughly 50 km upstream of Kootenay Lake. Preliminary findings indicate that juvenile sturgeon released at the Montana-Idaho border migrated downstream and remained within low-gradient habitat roughly 30 km from their release site. The fish released at the US-Canada border dispersed both upstream and downstream, with most remaining in low gradient river habitat. This aligns with the dispersal patterns observed 15 years ago, despite the increase in density of juveniles since that time. Juveniles are capable of large movements in this first year, are selecting low gradient habitats and rarely migrating to the lake. These findings help inform release location strategies to ensure fish are released in areas where density is supporting good growth.

LIFE-Boat4Sturgeon - an effort to save the four remaining Danube Sturgeons

Thomas Friedrich

University of Natural Resources and Life Sciences, Vienna (BOKU)

With the LIFE-Boat 4 Sturgeon project, its international partners pursue the goal of saving the remaining four sturgeon species in the Danube river basin from extinction. From 2022 to 2030, the project partners will be implementing six conservation measures to rescue the species Russian sturgeon, sterlet, stellate sturgeon and beluga sturgeon.

Evaluating Lake Sturgeon Spawning Site Use and the Relative Contribution of Spawning Tributaries to Harvest in the Lake Winnebago System

Samantha Embersits, 2. Daniel Isermann, 3. Daniel Dembkowski, 4. Margaret Stadig, 5. Joshua Raabe

Wisconsin Cooperative Fishery Research Unit, Fisheries Analysis Center, College of Natural Resources, University of Wisconsin-Stevens Point, 2. U.S. Geological Survey, Wisconsin Cooperative Fishery Research Unit, College of Natural Resources, University of Wisconsin-Stevens Point, 3. Wisconsin Cooperative Fishery Research Unit, Fisheries Analysis Center, College of Natural Resources, University of Wisconsin-Stevens Point, 4. Wisconsin Department of Natural Resources, 5. University of Wisconsin-Stevens Point, College of Natural Resources, University of Wisconsin-Stevens Point

The Lake Winnebago System (LWS) population in east-central Wisconsin represents one of the largest self-sustaining populations of lake sturgeon *Acipenser fulvescens* in North America that supports an annual spearing fishery each February. Lake sturgeon spawn at more than 70 locations within tributaries to the LWS, but the extent and timing of spawning at many sites remains unknown. Understanding the use of spawning locations is important in allocating sampling effort needed to mark fish and obtain population estimates used in setting safe harvest levels for the fishery. Furthermore, some spawning sites represent habitat improvement efforts implemented by the Wisconsin Department of Natural Resources and little to no evaluation has been performed at these sites to determine relative use and potential for successful hatching. Our objectives were to describe lake sturgeon use, measure egg deposition rates and survival, and verify whether hatching is occurring at selected spawning locations in the Wolf River drainage, including sites where habitat improvements have occurred. Spawning sites were visited repeatedly during 2024 and 2025, lake sturgeon were visually counted along defined transects, and sampling for eggs and larvae was conducted. Relative use and hatching success varied among locations, and we documented larval production at several new locations. Additionally, the broad range of spawning sites used by lake sturgeon creates the potential for multiple discrete spawning groups with unequal vulnerabilities to harvest. We utilized the passive integrated transponder (PIT) recapture histories of harvested sturgeon to determine the relative contribution of spawning groups to spearing harvest to prevent the over-exploitation of particularly vulnerable groups. Our results may help the Wisconsin Department of Natural Resources strategically allocate spring sampling effort so that more sites can be sampled and could provide guidance regarding future habitat improvement projects.

Sturgeon and Paddlefish Update from Missouri

Travis Moore

Missouri Department of Conservation

There's a lot going on for sturgeon and paddlefish in Missouri. We captured broodstock Lake Sturgeon and produced the first Missouri-born fingerlings, we continue to PIT tag a group of fingerlings for future age and growth validation, have been coordinating with the US Army Corps of Engineers on three Sustainable Rivers Program projects, have documented a second known wild spawning site, and are proposing a YOY thermal refuge project.

We're resampling Shovelnose Sturgeon in a fishery that has been closed for 12 years. Those fish have been protected by the federal Pallid Sturgeon Similarity of Appearance (SOA) rule. The SOA rule could be rescinded this year. What does that mean for both Shovelnose Sturgeon and Pallid Sturgeon management?

And our Paddlefish snagging season continues to be quite popular. What challenges face management of this species?

We'll cover brief updates on all of these species.

Developing a Protocol for Responding to Sturgeon Mortality Events: The Good, The Bad and The Putrid

Mary Moser, 2. Ken Lepla, 3. Jason Kahn, 4. James Crossman, 5. Andrea Schreier, 6. Dewayne Fox

Moserworks LLC, 2. Idaho Power, 3. National Marine Fisheries Service, 4. BC Hydro, 5. University of California-Davis, 6. Delaware State University

Recent mass mortalities of sturgeon have highlighted the need for a rapid response protocol to standardize data collection, determine causes, mitigate impacts, and ensure accurate reporting. A workshop was held at the 2024 North American Sturgeon and Paddlefish meeting to leverage the collective knowledge of attendees and create a framework to develop timely response plans that can be incorporated into management. Presentation of case studies (San Francisco Estuary, C. J. Strike Reservoir, Nechako and Delaware rivers) revealed several consistent themes: 1) pre-planning is needed to establish roles and responsibilities, 2) time is of the essence as sturgeon carcasses rapidly degrade and move, 3) carcass marking helps develop accurate counts, 4) access can be challenging and involving the public in data collection has pitfalls, 5) cross-agency communication is vital, and 6) real-time reporting tools and hotlines can help standardize data collection and speed response times. The group concluded that while significant resources and knowledge exist across agencies, formalized and comprehensive protocols are still needed to improve our ability to interpret mechanisms and facilitate comparison across populations. Recommendations for initial response, site containment, data collection, team coordination, and reporting/communication were summarized and a data reporting form developed. We intend to publish the final recommendations from this workshop so they can be widely adopted to improve future responses to sturgeon mortality events.

Known Knowns and Known Unknowns... A 15-year Retrospective on Paddlefish Management in Oklahoma

Jason D. Schooley

Oklahoma Department of Wildlife Conservation

On the occasion of my 15th anniversary as a Paddlefish biologist with Oklahoma Department of Wildlife Conservation, a natural period of self-reflection and retrospection was warranted. Though our Paddlefish research and management program has been held in high regard by many in this industry, has amassed large databases on the species, and has answered many valuable research questions aiding in sustainable harvest management, much is still to be learned locally and throughout the species range. By no means have we operated in a vacuum. Collaborative relationships with university professors, graduate students, federal partners, and other state managers provided assistance and knowledge, while MICRA, AFS, and NASPS have provided the means to share both. For this presentation, I will attempt to distill and briefly discuss key research questions that we feel are confidently answered as a direct result of our work in Oklahoma. In contrast, I will review research topics that plague us to this day as difficult to understand.

Attracting Lake Sturgeon back to a historical spawning location using effluent from tanks holding gravid broodstock

Cheryl Klassen, 2. Craig McDougall, 3. Patrick Nelson, 4. Stephanie Backhouse, 5. Don Macdonald

Manitoba Hydro, 2. North/South Consultants Inc., 3. North/South Consultants Inc., 4. Manitoba Hydro, 5. Nelson River Sturgeon Board

Spawning habitat enhancement for sturgeon species has often resulted in limited long-term success, raising questions about the process of spawning site selection. Acknowledging that Lake Sturgeon Acipenser fulvescens have well-developed chemoreceptors and the general potential for learned behaviour in fish, it was investigated whether Lake Sturgeon spawning could be reinduced at a habitat not contemporarily utilized by the species. The study was conducted where the Landing River empties into the Nelson River main stem in northern Manitoba, Canada. Effluent from streamside holding tanks containing gravid broodstock, presumably rich in hormones or pheromones, was discharged by hose into the Landing River during spring from 2019 to 2024. The attraction of Lake Sturgeon in the Landing River was then monitored using visual methods. After a nearly 20-year absence, Lake Sturgeon were successfully attracted back into the Landing River and spawning behaviour was observed. A maximum concurrent count of 30 Lake Sturgeon was observed via aerial drone in 2024. The first individuals observed in the Landing River each year often closely followed the timeline of luteinizing hormone releasing hormone injections into the broodstock and/or egg releases in the tanks, suggesting an acute attraction response related to hormones or pheromones associated with spawning that were contained in the effluent released into the Landing River. In three different observation years, the draw of effluent appeared to be eventually superseded by the draw of other fish and/or spawning activity within the river. Lake Sturgeon spawning site selection appears to be strongly influenced by the presence of conspecifics. In the future, it may be possible to produce synthetic Lake Sturgeon hormones or pheromones and release them into the water to guide Lake Sturgeon into habitats that are conducive to successful egg hatch and subsequent recruitment.

Utility of Side-scan Sonar for Monitoring Paddlefish

Wyatt Wolfenkoehler, 1. James M. Long, 2. Jesse R. Fischer, and 2. Josey L. Ridgway

Oklahoma State University, 1. U.S. Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit, Stillwater, OK, USA; 2. U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO, USA

Knowledge of Paddlefish population size and habitat use is important for the continued conservation of the species. Consumer-grade side-scan sonar (SSS) units are becoming increasingly used for monitoring large-bodied fishes such as Paddlefish. Although other large-bodied species, particularly benthic sturgeon, have been studied with this technology, Paddlefish differ in their pelagic habitat use. Beginning in 2020, we conducted several experiments to determine the utility of this technology to identify and count Paddlefish. Of note, we used SSS to validate images of a fiberglass Paddlefish model, which were used to estimate maximum detection distance. Subsequent distance sampling methods with SSS data were used in reservoir and riverine systems, which incorporated detection-by-distance effects and provided precise abundance estimates between readers. The accuracy of these methods were tested in several small reservoirs of varying sizes (8Ha–96Ha) with known abundances of Paddlefish, demonstrating the utility of this tool for providing precise and accurate estimates.

New Estimates of Sturgeon Abundance: The Integration of Side-Scan Sonar and Acoustic Telemetry in Hierarchical Models in the New York Bight

Daniel Millea, 2. Dewayne A. Fox, 3. Shannon L. White, 4. John A. Madsen, 5. David C. Kazyak, 6. Matthew W. Breece, 7. Amanda L. Higgs, 8. Ian A. Park, 9. Richard M. Pendleton, 10. Edward A. Hale

University of Delaware, 2. Delaware State University, 3. United States Geological Survey, 4. University of Delaware, 5. United States Geological Survey, 6. St. Mary's College of Maryland, 7. New York State Department of Environmental Conservation, 8. Delaware Department of Natural Resources and Environmental Control, 9. New York State Department of Environmental Conservation, 10. University of Delaware/Delaware Sea Grant

Endangered Atlantic Sturgeon (*Acipenser oxyrinchus*) face numerous threats, including bycatch in commercial fisheries and vessel strikes. Updated abundance estimates are crucial for tracking recovery progress, but the rarity and life history of Atlantic Sturgeon pose challenges when attempting to implement traditional fisheries techniques (e.g., mark-recapture) to estimate population size. Side-scan sonar provides a more robust, non-invasive alternative to traditional fisheries sampling methods for assessing small populations. Our study estimated the abundance of adult Atlantic Sturgeon in the Delaware and Hudson Rivers (the New York Bight Distinct Population Segment) using a Bayesian hierarchical model approach that combined side-scan sonar and acoustic telemetry. Nearly thirty years after the closure of the Atlantic Sturgeon fishery, population estimates over the last decade indicate two differing recovery trends within the New York Bight Distinct Population Segment. This study is the first to estimate adult Atlantic Sturgeon abundance using these methods for the Delaware River; however, population estimates for the Hudson River suggest that the abundance of Atlantic sturgeon has increased and that this system continues to support one of the largest populations of the species. Population trends can provide empirical evidence to evaluate the effectiveness of management strategies, which may be useful to broader conservation efforts.

Dietary state influences olfactory epithelium function in Lake sturgeon *Acipenser fulvescens*

Tyler Edwards, 2. Mark Fry, 3. Gary Anderson

University of Manitoba

Olfaction contributes significantly to the ability of all animals to sense their environment and is important for feeding. While the mechanism for sensing food in vertebrates is relatively well understood the interaction between the olfactory and endocrine systems regulating food intake remains less explored. In both mammals and fishes, food intake is typically regulated by satiety hormones originating from both central (e.g., hypothalamus) and peripheral tissues (e.g., gastrointestinal tissues). While extensive research has investigated fish feeding behaviour and food intake across different dietary states and hormone administrations, the specific impact of dietary state on the fish olfactory system remains largely unknown.

The goal of this study was to investigate the transcriptional and physiological changes in the olfactory epithelium of Lake sturgeon (*Acipenser fulvescens*) under differing dietary states. Lake sturgeon were fed (ad-libitum) or fasted for 14 days, with the olfactory epithelium sampled at 24, 48, 168, and 336 hours (n = 6–8 time-point/treatment) for messenger RNA sequencing. Additionally, olfactory responses were assessed using electro-olfactogram (EOG) in fed (ad-libitum) and fasted (14-days) individuals, measuring responses to different concentrations of known dietary odorants (n = 5–6 treatment). We observed a significant increase in EOG responses in fasted individuals, suggesting that the olfactory epithelium undergoes remodeling following a 14-day fast enhancing dietary odorant detection potentially relating to the detection of food cues. This remodeling will be discussed in the context of observed changes overtime in the transcriptional analysis of the olfactory epithelium.

Restoring functional white sturgeon early rearing habitat in the Nechako River: challenges due to bedload movement in an active river channel

Steven McAdam, 2. Angie Coulter, 3. Simon Gauthier-Fauteux, 4. Andre Zimmerman

BC Ministry of Water, Land and Resource Stewardship, 2. BC Ministry of Water, Land and Resource Stewardship, 3,4. Northwest Hydraulics Consultants

River regulation routinely affects sturgeon spawning habitat either via blocking access to upstream spawning habitat or altering habitat quality in downstream spawning reaches. Restoring functional spawning and early rearing habitat in reaches well downstream of dams present unique challenges due to the need to restore functional habitats within the active, regulated river channel. The Nechako River, Canada, has been affected by over 70 years of flow regulation, leading to the recruitment collapse of the Nechako white sturgeon (*Acipenser transmontanus*), which has been ongoing since 1967. Restoration efforts have progressed from bench scale lab studies to large in-stream habitat restoration. Field monitoring shows that movement of fine substrates in the active channel of the Nechako River presents substantial challenges due to the presence of rapid infilling. Substrate cleaning investigations in 2025 utilized a proprietary 'sled' to improve surficial substrate conditions within the spawning habitat. Physical evaluation showed improvements in response to cleaning, as well as rapid infilling with sand and fines. Ongoing modifications are required to develop substrate cleaning approaches that are not depth limited, and to develop methods to limit bedload sand inputs to the spawning habitat during the early rearing period. Restoring suitable early rearing habitat, even just during the restricted period when embryos and yolksac larvae are present, may require repeated annual treatments and underscores the challenge of implementing substrate restoration in a geomorphically active channel.

The role of geomorphology in restoration planning, design, and monitoring

Simon Gauthier-Fauteux, Andre Zimmermann

Northwest Hydraulic Consultants

In the complex, interdisciplinary practice of stream restoration, a river's interacting fluvial and biological processes often influence and can even dictate project success. The geomorphological drivers underlying a riverine environment therefore require careful consideration and are integral to the development of more informed river restoration planning, design, and monitoring projects.

Over the past decade, geomorphological studies on the Nechako and Columbia rivers in northwestern Canada have been supporting ongoing efforts to restore functional spawning and early rearing habitat for white sturgeon (Acipenser transmontanus). The studies have informed and contributed to restoration planning by providing a clearer understanding of existing substrate characteristics, instream hydraulics, and patterns of sediment transport, in terms of both sediment mobility and infilling rates. Geomorphological studies have also been used to inform restoration design by more clearly identifying limiting factors and evaluating the potential effectiveness of proposed restoration methods.

Innovative approaches are now being used to monitor the effectiveness and longevity of restoration treatments. In some cases, monitoring instrumentation has been directly incorporated into the restoration design to allow for real-time monitoring of physical habitat conditions. Such novel applications may be instrumental in not only evaluating restoration performance but also determining the optimal timing for maintenance or remediation.

Addressing recruitment failure of endangered White Sturgeon: A case study using structured decision making to guide spawning habitat restoration in the Upper Columbia River, Canada

James A. Crossman[1], Margo Sadler[2], David T. West[3], Todd Hatfield[4], and D. Steven O. McAdam[5]

[1]Fish and Aquatics, BC Hydro, 601 18th Street, Castlegar, British Columbia, V1N 2N1, Canada.
[2]Fish and Wildlife Compensation Program, BC Hydro, 6911 Southpoint Drive, Burnaby, BC, V3N 4X8
[3]Ecofish Research Ltd., Vancouver, British Columbia, Canada
[4]Ecofish Research Ltd., 600 Comox Rd., Courtenay, BC V9W 2X9, Canada.
[5]British Columbia Ministry of Water, Land and Resource Stewardship, University of British Columbia, Vancouver, British Columbia, Canada.

Recovery of critically imperiled taxon like sturgeons (order *Acipenseriformes*) requires effective conservation actions that address multiple concurrent stressors on population persistence. Geomorphological change to substrate conditions at spawning sites was identified as the most plausible cause where restoration could have a positive effect on recruitment for endangered white sturgeon (*Acipenser transmontanus*) in the Upper Columbia River. Here we describe outcomes from a formal process to prioritize sites for spawning habitat restoration that met biological and physical criteria to ensure effectiveness following implementation. Existing substrate conditions were described at multiple spawning locations and the biological (e.g., interstitial space) and physical (e.g., substrate mobility) functionality was assessed using expert opinion and existing literature. Structured decision-making was used to develop restoration alternatives and prioritize one for construction in-river. The leading alternative was built in-river between October 2022 and April 2023 over an area of 5,800 square meters. Substrate material was placed to a depth of two times the largest particles size (i.e., 0.60 m), and the composition of the rock provided a mix of larger material (maximum size = 0.30 m diameter) to provide substrate retention and smaller material (minimum size = 0.10 m) to provide suitable interstitial habitat for sturgeon early life stages. Multiple spawning events were detected in each of the first three years following construction and physical monitoring indicates limited infilling of substrates. While simple in concept, implementation of substrate restoration within large river habitats is a challenging undertaking but represents a positive shift toward habitat-based recovery efforts.

Keeyask Generating Station Lake Sturgeon spawning shoal construction and monitoring

Carolyne Northover

Manitoba Hydro

The Keeyask Generating Station was recently constructed at Gull Rapids on the Nelson River in northern Manitoba. Gull Rapids was the only known spawning site for the Lake Sturgeon in Stephens Lake downstream of the rapids. When the Keeyask Hydropower Limited Partnership proposed Keeyask it was known that this spawning habitat would need to be replaced. A plan was developed for constructing artificial habitat in the powerhouse tailrace. The spawning shoal was constructed behind a dewatered cofferdam in 2019. Generating units came into service to produce power starting in 2021. Spring 2021 was the first time the constructed habitat was available with water velocities suitable for spawning. Monitoring of adult Lake Sturgeon has occurred annually since then in spring to observe movements of Lake Sturgeon in Stephen Lake towards the tailrace. In autumn, juvenile Lake Sturgeon are studied in Stephens Lake to determine the size of the population as well as the demographics. With a concurrent Lake Sturgeon stocking program, success of the spawning shoal, is determined by the results of the wild portion of the population, particularly looking at the 2021, 2022 and 2023 cohorts so far. This year the 2024 cohort will be added. Wild born Lake Sturgeon from each of these three year classes have been captured indicating early success of the constructed spawning shoal.

Pallid Sturgeon Spawning Habitat in the Missouri River Basin

Caroline Elliott, 1. Aaron DeLonay, 2. Patrick Braaten, 3. Luke Holmquist, 4.Jenna Ruoss and 5. Jason Kral

U.S. Geological Survey
1. U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO
2. U.S. Geological Survey, Columbia Environmental Research Center, Fort Peck, MT
3. Montana Fish, Wildlife, and Parks, Lewistown, MT
4. University of Nebraska-Lincoln School of Natural Resources, Lincoln, NE
5. U.S Fish and Wildlife Service, Yankton, SD

Pallid sturgeon (Scaphirhynchus Albus) occupy the turbid, sand-bedded Mississippi and Missouri Rivers and several of their major tributaries. Various habitat modifications and management actions to encourage reproduction and recruitment have been proposed or implemented across the range of rivers where pallid sturgeon spawn. Evidence indicates pallid sturgeon use discrete habitats for spawning, embryo incubation, and hatch. Complementary research and monitoring efforts have documented spawning in the mainstem Missouri and Yellowstone Rivers, and in adjacent tributaries, including the Powder River, Tongue River, and Platte River. Spawning has been confirmed through adult reproductive assessments, telemetry, imaging sonar, and egg and larval sampling. Since 2007, habitats in thirty confirmed or putative spawning reaches have been mapped to understand the depths, velocities, and substrates where spawning happens. Single and multibeam sonar, acoustic Doppler current profilers, and substrate assessments were used to characterize spawning habitats. In the highly altered Lower Missouri River, spawning locations are scattered from Mid-Missouri upstream to South Dakota in patches that are deep and fast with substrates that include bank revetment, bedrock, gravel, and sand. In contrast, in the relatively unaltered Yellowstone River pallid sturgeon spawn at few locations with depths and velocities similar to average channel conditions within patches of gravel and sand dunes. Recent (2022–2024) mapping of habitats at observed spawning sites in the Powder, Tongue, and Platte Rivers, and in the most upstream portion of the species' range in the Upper Missouri River above Fort Peck Dam have increased our understanding of where and under what conditions spawning, incubation, and hatch of embryos happens. Improved understanding of functional spawning habitats is a critical component in the implementation and monitoring of management actions from construction of fish passage alternatives, to flow and temperature manipulation downstream of mainstem dams, and potential spawning habitat enhancement in priority river reaches.

The response of Kootenai(y) River White Sturgeon to flow and temperature management

Sean Wilson, 2. Kevin McDonnell, 3. Gregory Hoffman, 4. Troy Smith, 5. Ryan Hardy, 6. Marley Bassett, 7. Nathan Jensen, 8. Taylor Dudunake

Idaho Department of Fish and Game, 2. Minnesota Department of Natural Resources, 3. U.S. Army Corps of Engineers, 4. Idaho Department of Fish & Game, 5. Idaho Department of Fish & Game, 6. B.C. Ministry of Water, Land and Resource Stewardship, 7. Kootenai Tribe of Idaho, 8. U.S. Geological Survey

Natural production of Kootenai (spelled Kootenay in Canada) River White Sturgeon (sturgeon) has been limited by several anthropogenic actions in the watershed over the last century, including construction of extensive levees and operation of hydropower and flood control dams upstream (Libby Dam in Montana) and downstream (Corra Linn Dam in British Columbia). Sturgeon currently spawn primarily over clay and silt substrates that cause entombment of fertilized gametes. Strategies to restore natural recruitment include providing flows and temperatures at Libby Dam to attract fish upstream to suitable spawning habitat (i.e. gravel substrates), improving and creating available habitat where suitable substrates exist upstream, and placing suitable substrates in current spawning locations downstream. We monitored spawning migrations of female sturgeon using acoustic telemetry and egg deposition using egg mats. We used a logistic model to evaluate factors thought to influence migration and an occupancy model to evaluate factors influencing egg deposition. Results of the logistic model will be presented and discussed. The occupancy model identified temperature as the primary driver of egg deposition and predicts that deposition will occur between 8 and 12°C. These results will inform manipulation of discharge and temperature from Libby Dam to maximize the probability of sturgeon migrating to and depositing eggs in suitable spawning habitat.

Leveraging Citizen Science Data with Advanced Statistical Models: Recent Updates on Lake Sturgeon Monitoring in Alberta

Stephen Spencer, Inesh Munaweera

Alberta Government, MacEwan University

The Lake Sturgeon (Acipenser fulvescens) is an ancient and long-lived species threatened by overharvesting, habitat degradation, and fragmentation. Declining population numbers in Alberta led to its listing as "Threatened" under the Wildlife Act in 2007. We used data from individually marked fish, captured largely by citizen scientists over a 30-year period, to assess population status. Despite challenges with data quality and model convergence, the frequentist Jolly-Seber models provided usable population estimates.

Using fin ray elemental signatures and growth zone width to estimate onset of sexual maturity in lake sturgeon (*Acipenser fulvescens*)

Alaina Taylor, 2. Douglas Larson, 3. Kim T Scribner, 4. Edward A. Baker, 5. Norman M. Halden, 6. W. Gary Anderson

WSP Canada Inc. & University of Manitoba, 2. Michigan State University, 3. Michigan State University, 4. Michigan Department of Natural Resources, 5. University of Manitoba, 6. University of Manitoba

Characterizing inter- and intra-population levels of variability in age at sexual maturation for long-lived fishes provides insight into year-class strength and recruitment dynamics, allowing for more effective management practices. Here we analyzed the ontogenetic chronology of pectoral fin ray annuli trace elemental concentration profiles as well as changes in annuli growth in lake sturgeon (*Acipenser fulvescens*) to determine onset of sexual maturity (OSM). Elemental concentrations and growth-zone width were used to build a random forest classification model to discriminate year-specific signatures to before or after OSM from 98 individual fin rays from both sexes across multiple populations and watersheds. The model demonstrated an overall accuracy of 98.8%. Ba was the most important variable related to OSM discrimination success followed by zone width, Pb, Mn, Mg, Zn, Cu, and Sr. Fin ray elemental concentrations began to increase at approximately age 24 (±4.7 years) in females and 15 (±3.1 years) in males while zone width decreased. This study implies that new applications for fin ray microchemistry are possible and could benefit future fisheries management strategies specifically by adding nonlethal or less invasive sampling techniques for evaluating OSM in sturgeon.

Acclimation to Elevated Temperature Results in Confounding Results in Lake Sturgeon (*acipenser fulvescens*) Across Biological Scales

Scott Lankford, Brady Blede, Nick Barts, Dustin Mathena

University of Central Missouri

Anthropogenic change represents one of the largest threats to freshwater fishes, with habitat loss and altered thermal conditions being among the greatest challenges. Populations of species with wide latitudinal distributions, such as the lake sturgeon, will likely experience varying levels of stress in the face of global change, and understanding this will be key to predicting how species cope with future environmental threats. In the southern reaches of lake sturgeon distributions, individuals experience increased habitat fragmentation and warmer water temperatures than those from northern areas on average. Previous work in northern populations of Lake Sturgeon documented temperature effects across levels of biological organization, with warmer temperatures generally resulting in increased stress. In our study, we investigated whether temperature acclimation altered organismal metrics of health as well as metabolic physiology at the enzymatic and organismal levels in juvenile lake sturgeon collected from a hatchery in Missouri, but sourced from northern broodstock. We found that fish raised at 15°C had the highest overall survivability (97%) when compared to both the 20°C (86%) and 25°C (61%) treatments, and fish in the cold treatment similarly exhibited a higher hepatosomatic index and scored activity rates. Routine metabolic rate did not vary across temperature treatments, but maximum metabolic rate exhibited a significantly positive relationship with increasing temperature; however, this did not result in any differences in metabolic scope between the treatments. At the enzymatic level, citrate synthase activity did not respond to changes in temperature, suggesting thermal resilience at both biological scales examined. Interestingly, lactate dehydrogenase activity trended towards greater activity in fish reared at 15°C, suggesting an increased reliance on anaerobic metabolism. Overall, our results suggest that increasing temperatures will have a negative impact on the survival and condition of juvenile lake sturgeon, but the exact physiological mechanisms underlying this phenomenon remain unclear.

Suspended sediment effects on juvenile White Sturgeon performance

1. Kelly D. Hannan; 1. Sammuel Haung; 1. Anna E. Steel; 2. Christa M. Woodley; 2. Dave L. Smith; 1. Nann A. Fangue

1. University of California, Davis 2. USACE Engineer Research and Development Center

Dredging activities can generate plumes of suspended sediment in aquatic habitats. While many fish species are expected to avoid such plumes, this response is rarely quantified and may not apply to benthic feeders like sturgeon. In fact, it has been suggested that adult White Sturgeon (*Acipenser transmontanus*) may be attracted to dredging activities, raising questions about the physiological consequences of sediment exposure.

To address this, we investigated how short-term exposure to elevated suspended sediment affects swimming performance and metabolic capacity in juvenile White Sturgeon. Fish were exposed to either a control treatment (~1 NTU) or a high-sediment treatment (~85 NTU), simulating active dredging conditions. Swimming performance was assessed using fixed-velocity endurance trials, from which we generated endurance curves based on time-to-fatigue data and estimated entrainment risk from observed behaviors and swimming capacity. Metabolic capacity was evaluated separately using intermittent respirometry in custom sediment-compatible chambers. Preliminary results suggest that sediment exposure may not impair endurance swimming but may enhance maximum metabolic rate. These findings challenge the assumption that suspended sediments are detrimental and may reflect adaptive responses in sturgeon physiology. By linking sediment exposure to both behavioral and physiological endpoints, this work informs the development of evidence-based dredging guidelines that balance ecosystem needs with operational demands.

Poster Abstracts

Investigating the dynamics of lake sturgeon (Acipenser fulvescens Rafinesque, 1817) in the Severn River, Ontario

Angus McBride

Trent University

Ontario's far north region is one of the world's last intact landscapes, with extensive unfragmented river systems supporting lake sturgeon populations that remain relatively unaffected by industrial development. Unlike many sturgeon populations globally, lake sturgeon in the Hudson/James Bay lowlands, including the Severn River, have avoided historical declines due to the remoteness of their habitat. However, increasing interest in resource extraction, including mining projects within the region, underscores the urgency of documenting population dynamics for this species before potential impacts occur. This study will assess the dynamics and growth of lake sturgeon in the Severn River through index netting and biological sampling. Indigenous harvesters will provide fin rays and otoliths for aging and growth analyses, while structured netting protocols will help determine population structure and relative abundance. An analysis of distribution will explore ontogenetic structuring, informing potential conservation measures should habitat fragmentation emerge as a concern. In collaboration with Indigenous communities, key knowledge holders will provide insights into sturgeon behavior, habitat use, and local fisheries. Their contributions will guide site selection and logistical considerations to ensure culturally informed research practices. Sampling locations will be identified using ArcGIS software, and Bayesian models will assess population drivers, providing robust estimates of sturgeon abundance and growth dynamics. This research will establish critical baseline data for lake sturgeon in the Severn River, supporting evidence-based conservation strategies amid increasing development pressures. Through the braiding of Indigenous knowledge and modern fisheries science, the study contributes to sustainable lake sturgeon management in one of the few remaining pristine river systems worldwide.

Genetics of lake sturgeon (*Acipenser fulvescens*) in the 'pristine' Severn River

Jenna Scott, 2. Tom Whillans, 3. Kevin Reid, 4. Chris Wilson

Trent University, 2. Trent University, 3. Anishinabek/Ontario Fisheries Resource Centre, 4. Ontario Ministry of Natural Resources/Trent University

Lake sturgeon populations have declined throughout much of the species' range, in part due to habitat fragmentation/loss and commercial harvesting. The Severn River in northwestern Ontario is believed to contain one of the last remaining 'pristine' populations of lake sturgeon. Given that many sturgeon populations have declined past their historic levels of abundance, historical genetic diversity is largely unknown. The Severn River population offers a rare opportunity to document genetic diversity and abundance in a relatively pristine system. These data will be invaluable as baseline information to detect potential changes resulting from future development activities. Lake sturgeon have been harvested by Indigenous Peoples for generations and hold profound cultural importance. Working with local First Nation communities, ageing and genetic samples will be collected from harvested and nonlethally-sampled lake sturgeon. Then, standardized panels of single nucleotide polymorphism (SNP) and microsatellite markers will be used to quantify the number of genetic groups and assess diversity and divergence within and among these groups, as well as to estimate the number of effective breeders (Nb) and effective population size (Ne), which are key metrics for evaluating a population's resilience to environmental stress. Close-kin mark recapture, a statistical method of calculating abundance based on kinship, will be used to estimate local lake sturgeon numbers in the Severn River. Failure to protect sturgeon populations would risk not only biological loss but also the erosion of a sacred resource central to Indigenous culture, which predates colonial impacts that contributed to sturgeon declines. These genetic and demographic insights will directly inform management strategies, ensuring that this culturally and ecologically significant species is preserved.

Allometric Variation in Egg Characteristics Across the Range of Paddlefish

Shasta Kamara, 2. Joelle Busby, 3. Cory Suski

Program in Ecology, Evolution, and Conservation Biology, University of Illinois Urbana-Champaign, 2. Department of Natural Resources and Environmental Sciences, University of Illinois Urbana-Champaign, 3. Department of Natural Resources and Environmental Sciences, University of Illinois Urbana-Champaign

American Paddlefish (*Polyodon spathula*) have important commercial and recreational fisheries throughout their range, which covers a wide latitudinal gradient. This large range has led to the expression of compressed life history strategies in the southern reaches of their range compared to the longer-lived, later-maturing fish in the northern extent of their range. This difference in life history, paired with the commercial importance of paddlefish in the caviar industry, means that larger, older, and potentially more fecund female paddlefish are often disproportionately removed from the population relative to smaller females, which could have implications for which females contribute offspring to a population. This could possibly result in problems with recruitment if smaller females with lower quality eggs are left to spawn. Quantifying latitudinal trends in paddlefish life history through gamete characteristics can aid in the management of stocks and in predicting how paddlefish life history may change with climate warming. Therefore, the goal of this study is to quantify size-based variation in paddlefish gamete characteristics, with an emphasis on females and egg characteristics throughout their range. To accomplish this goal, we collected egg samples from 130 females in two ways across the latitudinal distribution of paddlefish. First, we obtained eggs from wild-caught hatchery broodstock in Louisiana, Missouri, and South Dakota. Second, we collected eggs via direct collections or angler donations in Oklahoma, Missouri, Illinois, and Montana. Eggs will be assessed for a number of characteristics related to offspring nutrition and development, and will be compared across sizes within a latitude, as well as across latitudes, to quantify reproductive strategies across the continent. This information will aid paddlefish managers in determining which females in a population are more likely to produce offspring that will successfully recruit and therefore are the most important to conserve.

Initial results from an adult Lake Sturgeon oxy-thermal habitat use in a Missouri River tributary

Levi Umland, 2. Dr. Craig Paukert

Missouri Cooperative Fish and Wildlife Research Unit, 2. U.S. Geological Survey

In Missouri, Lake Sturgeon were listed as a state endangered species in 1974, and reintroduction efforts began in 1984. Part of that effort is to understand the habitat selection of adult Lake Sturgeon, particularly since there is concern that cool water habitat may be limited in Missouri rivers. During the winter of 2024/2025 we captured and implanted temperature/depth acoustic transmitters in 40 adult Lake Sturgeon within a deep-water reach of the Osage River, a larger tributary of the Lower Missouri River where adult Lake Sturgeon seem to aggregate during the summer/winter and contains a pool like habitat. This 14 m deep (about 6 times as deep as surrounding reaches) by 1.5 km long river reach is known to stratify by dissolved oxygen (DO) and temperature under consistent low flows. During early summer we deployed remote receivers to complete a 21-receiver array to monitor adult Lake Sturgeon spatial movements. We measured temperature/DO profiles to compare temperatures and depths selected for vs. other readily available habitat. In addition, a logger equipped with DO and temperature sensors was deployed in the lower end of this reach for monitoring how DO and temperature varied by flow in this unique system. To date, The average depth used by adults thus far is 5.8 m, and 19 out of the 40 tagged adults have remained within this unique deep-water area.

Data Integration and Management Across Multiple Programs to Support Pallid Sturgeon Restoration Efforts

Kimberly Chojnacki, Chad Vishy, Parker Golliglee, Aaron DeLonay

U.S. Geological Survey, Columbia Environmental Research Center

While restoration efforts for Lake Sturgeon (*Acipenser fulvescens*) in the Great Lakes region show promising signs, the assessment of recovery progress is hindered by a lack of strong demographic data. Traditional mark-recapture techniques for estimating abundance in sturgeon are often challenged by low recapture rates and life history traits like intermittent spawning, which can lead to biased estimates. This research will address these challenges by testing the efficacy of close-kin mark-recapture (CKMR), a genomics-based method, to estimate population size and other demographic parameters for recovering populations in Ontario. Concurrently, we will investigate fine-scale population structure and connectivity among spawning groups. The project will leverage an extensive archive of existing tissue samples, which will be genotyped using newly-developed, high-resolution single nucleotide polymorphism (SNP) markers. This approach maximizes the value of historical collections and provides significantly greater power for identifying parent-offspring pairs and delineating genetically distinct populations than previous methods. By generating reliable abundance estimates and a high-resolution map of genetic connectivity, this study will provide critical data for management. These outcomes are essential for accurately evaluating the success of current conservation strategies, identifying management units, and guiding future recovery actions for Lake Sturgeon.

Applying Conservation Genomics and Close-Kin Mark-Recapture to Assess Lake Sturgeon (*Acipenser fulvescens*) Recovery in Ontario Canada

Collin Atwood. 2. Chris Wilson

Trent University, 2. Ontario Ministry of Natural Resources and Forestry, Aquatic Research and Monitoring Section, Trent University

While restoration efforts for Lake Sturgeon (*Acipenser fulvescens*) in the Great Lakes region show promising signs, the assessment of recovery progress is hindered by a lack of strong demographic data. Traditional mark-recapture techniques for estimating abundance in sturgeon are often challenged by low recapture rates and life history traits like intermittent spawning, which can lead to biased estimates. This research will address these challenges by testing the efficacy of close-kin mark-recapture (CKMR), a genomics-based method, to estimate population size and other demographic parameters for recovering populations in Ontario. Concurrently, we will investigate fine-scale population structure and connectivity among spawning groups. The project will leverage an extensive archive of existing tissue samples, which will be genotyped using newly-developed, high-resolution single nucleotide polymorphism (SNP) markers. This approach maximizes the value of historical collections and provides significantly greater power for identifying parent-offspring pairs and delineating genetically distinct populations than previous methods. By generating reliable abundance estimates and a high-resolution map of genetic connectivity, this study will provide critical data for management. These outcomes are essential for accurately evaluating the success of current conservation strategies, identifying management units, and guiding future recovery actions for Lake Sturgeon.

Quantifying Tolerance and Performance of Paddlefish Across Temperatures

Sandra Leal, Shasta Kamara, Joelle Busby, Cory Suski

University of Illinois Urbana-Champaign (UIUC)

While conservation aquaculture has become a critical component of recovery programs for sturgeon species worldwide, many programs were initiated in the absence of information needed to inform critical decisions regarding numbers of progeny released, their sizes and ages, and how to maximize genetic diversity. For approximately the last 40 years, recruitment of White Sturgeon (*Acipenser transmontanus*) in the Transboundary Reach of the Columbia River has not occurred at a rate sufficient to maintain the population. Accordingly, the population has been the focus of intensive recovery efforts undertaken in both Canada and the United States under a coordinated recovery initiative that includes multiple entities including regulatory agencies, industry, first nations, and stake holders. Conservation aquaculture has been the main recovery measure under the initiative in order to meet two objectives, i) prevent extirpation until natural recruitment can be restored by rebuilding the natural age class structure, and ii) preserve the wild genetic variability of the existing wild population. While releases of hatchery-origin progeny has largely resulted in extirpation being avoided, it has not come without challenges and continual refinement. We present an overview of how the conservation aquaculture program was adaptively managed in response to new information over 24 years, describe changes in methods to produce progeny for release, and highlight both successes and unanticipated outcomes from post-release monitoring. Lessons from recovery of Upper Columbia White Sturgeon can be used to improve practices to increase post-stocking survival and genetic diversity but should also be seen as a cautionary tale to recovery programs either in their infancy or that lack adequate post-release monitoring results.