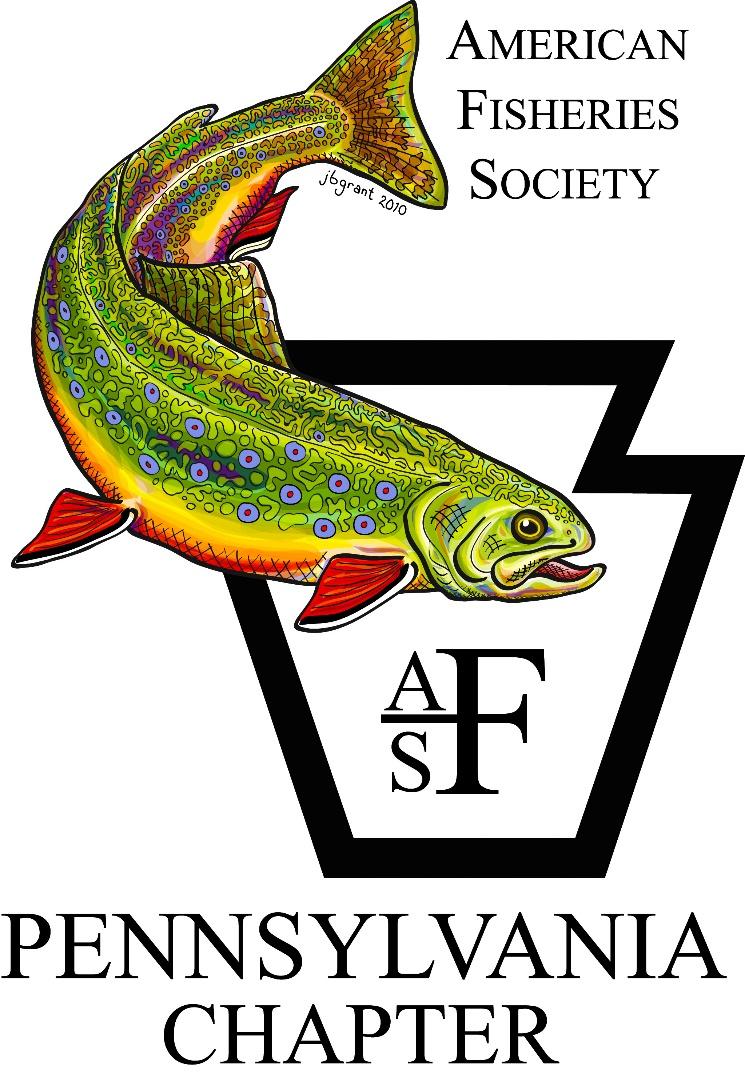
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**Presents**

**The 2021 Technical Meeting**

***Adapting to Change***

February 11– 12, 2021

Virtual Meeting via Zoom

**Registration Information**

Meeting Registration: <https://psu.zoom.us/webinar/register/WN_LcUso0M4SQGGCGfd46_S7w>

Workshop Registration: <https://psu.zoom.us/webinar/register/WN_jntVpLVnTCuym6PWW_UnLA>

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**Schedule**

**Thursday February 11th, 2021**

|  |  |
| --- | --- |
| **Time** | **Activity** |
| 8:00 – 8:45 | **Technical set up: Check-in and registration** |
| 8:45 | Welcome and introductions: George Merovich |
| 9:00 | **PLENARY: Dr. Prosanta Chakrabarty,** Louisiana State University, Ichthyology in the age of COVID |
|  | **MORNING TECHNICAL SESSION** |
|  | ***Climate Change: thermal and flow impacts to fishes*** |
| 10:00 | **Argent and Kimmel –** Thermal sensitivity and resiliency among coldwater streams |
| 10:20 | **\*\*King et al.** – Long-term flooding impacts in Brook Trout populations in an Appalachian Mountain watershed |
|  | ***Conservation, Monitoring, and Assessment of fishes*** |
| 10:40 | **Wertz** – Real world examples of a thermal fish index-based assessment |
| 11:00 | **\*\*Gillies** – Tools for passive acoustic and video monitoring of soniferous fishes in western Pennsylvania lentic environments |
| 11:20 | **Shirey et al.** – Saving fishes from extinction in the United States: a focus on Endangered Species Act recovery plans and expenditures |
| 11:40 | **Lunch** |
|  | **AFTERNOON TECHNICAL SESSION** |
|  | ***Invasive Species*** |
| 1:00 | **Merovich et al.** – Difficulty identifying rusty crayfish x Allegheny crayfish hybrids in the Juniata River watershed |
| 1:20 | **\*\*Herigan et al. –** Nursery habitat characteristics of the invasive, omnivorous Rudd (*Scardinius erythrophthalmus*) |
| 1:40 | **Henning** – Utilization of Environmental DNA in Monitoring Invasive Northern Snakehead and Blue Catfish in the Lower Susquehanna River |
|  | ***Poster session: Lightning talks*** |
| 2:05 | **\*\*Miller et al.** – Stream connectivity and fragmentation impacts on wild trout populations |
| 2:15 | **Stenger** – Fish biodiversity in the Upper Standing Stone Creek Watershed, Huntingdon County, Pennsylvania |
| 2:25 | **\*\*Smith et al.** – Classification of ecological conditions in the Little Juniata River watershed |
| 2:35 | **\*\*Gardineer et al.** – Are BMPs effective? Evaluating best management practices by tracking fish population response |
| 2:45 | **Behrens et al.** – Regions of genetic divergence in depth-separated *Sebastes* species pairs: Depth as a potential driver of speciation |
| 2:55 | **\*\*Stark et al.** – Evaluating sampling techniques of Flathead Catfish, *Plyodictis olivaris,* in the Susquehanna River Basin for dietary analysis |
| 3:05 | ***Conclusion of technical session – wrap up*** |
|  | BREAK |
| 3:15 | **National AFS Officers/Staff:** President Brian Murphy and Executive Director Doug Austen |
| 3:45 | **PA Chapter AFS business meeting** |
| 5:00 | **Adjourn** |

**\*\* Eligible for Best Student Presentation award**

**Friday February 12th, 2021**

**Workshops**

**Session 1: 8:00 – 9:50 am; Session 2: 10:00 – 11:50 am**

|  |  |
| --- | --- |
| **Time** | **Activity/Location** |
| 7:30 – 8:00 am | Registration and technical set up |
|  |  |
| 8:00 am | PA Department of Environmental Protection Data Tools Workshop  Dustin Shull, PA DEP |
| 10:00 am | Interactive Mapping in R: Don’t get caught up in the static  Matt Shank, PA DEP |
| 12:00 pm | Conference adjourns |

**Workshop Descriptions**

**Workshop 1:**

**PA Department of Environmental Protection Data Tools Workshop**

**Instructor: Dustin Shull PADEP**

This workshop will review the water quality data tools PA DEP currently has available to the public. Data types will include chemical, macroinvertebrate, physical habitat, and water quality assessment information. Each resource will be demonstrated, and time will be allotted for questions and discussion afterward. This workshop will include the publicly available resources listed below.

1. Water Chemistry
   * 1. Mapping Application: <http://www.depgis.state.pa.us/emappa/>
     2. Instructional Video: <https://www.youtube.com/watch?v=gt4Wi6b4aUk&feature=youtu.be>
2. Macroinvertebrates (and habitat)
   * 1. StoryMap: <https://www.depgis.state.pa.us/macroinvertebrate/index.html>
     2. Mapping Application: <http://www.depgis.state.pa.us/macroviewer/index.html>
     3. Instructional Video: <https://www.youtube.com/watch?v=zYzbKrNik-0&feature=youtu.be>
3. Integrated Report
   * 1. Narrative: <https://www.depgis.state.pa.us/2020_Integrated_Report/>
     2. Mapping Application: <https://www.depgis.state.pa.us/IRViewer2020/>
     3. Instructional Videos: <https://www.youtube.com/watch?time_continue=12&v=tg6UDAWb2Mw&feature=emb_logo> / <https://www.youtube.com/watch?v=m777Jrt4p08&feature=emb_logo>

**Workshop 2:**

**Interactive Mapping in R: Don’t get caught up in the static**

**Instructor: Matt Shank PADEP**

Interactive maps are far superior to static maps when the subject matter is spatially complex or data-rich. Users can zoom, click, and pan, while absorbing far more information via additional map components. Point and polygon layers can be included from various sources, including Geographic Information System shapefiles. Repeated time-series can be delineated and turned on/off, while pop-up boxes can be loaded with information. Completed maps can be published as web pages or html files, that allows easy sharing and outreach to collaborators and the public.

The R statistical environment has many user-friendly packages that allow for the creation of interactive maps. This workshop will rely mainly on the leaflet and sf packages to create an interactive map showing the distribution of two invasive fishes, blue catfish and northern snakehead, in the lower Susquehanna River. All participants should have Rstudio version 3.6.3 or later installed, as well as the following packages: readxl, janitor, viridis, USAboundaries, sf, leaflet,  leaflet.extras, htmlwidgets, tidyverse, tidylog. Participants are also encouraged to make an [***R****Pubs*](https://rpubs.com/) account prior to the training.

All spatial data files and R code will be available from github prior to the training. The workshop will take place in webinar format, with a moderator helping the instructor manage issues. The process of building various iterations of the map will be covered line-by-line. Participants will be encouraged to follow along virtually, and will hopefully have published a polished map by the end of the session.

**Meeting At A Glance**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Presentation Type** | **Time** | **Student** | **Presenting Author** | **Short Title** | **Abstract page #** |
| **PLENARY** | 9:00 |  | Prosanta Chakrabarty | Ichthyology in the age of COVID | 1 |
| **ORAL** | 10:00 |  | David Argent | Thermal sensitivity and resiliency among coldwater streams | 2 |
| 10:20 | Y | Benjamin King | Long-term flooding impacts in Brook Trout populations in an Appalachian Mountain watershed | 3 |
| 11:00 |  | Tim Wertz | Real world examples of a thermal fish index-based assessment | 4 |
| 11:20 | Y | Daniel Gillies | Tools for passive acoustic and video monitoring of soniferous fishes in western Pennsylvania lentic environments | 5 |
| 11:40 |  | Patrick Shirey | Tools for passive acoustic and video monitoring of soniferous fishes in western Pennsylvania lentic environments | 6 |
| 1:00 |  | George Merovich | Difficulty identifying rusty crayfish x Allegheny crayfish hybrids in the Juniata River watershed | 7 |
| 1:20 | Y | Garrett Herigan | Nursery habitat characteristics of the invasive, omnivorous Rudd (Scardinius erythrophthalmus) | 8 |
| 1:40 |  | Aaron Henning | Utilization of Environmental DNA in Monitoring Invasive Northern Snakehead and Blue Catfish in the Lower Susquehanna River | 9 |
| **POSTER** | 2:05 | Y | John Miller | Stream connectivity and fragmentation impacts on wild trout populations | 10 |
| 2:15 |  | Logan Stenger | Fish biodiversity in the Upper Standing Stone Creek Watershed, Huntingdon County, Pennsylvania | 11 |
| 2:25 | Y | Nicholas Smith | Classification of ecological conditions in the Little Juniata River watershed | 12 |
| 2:35 | Y | Kaitlyn Gardineer | Are BMPs effective? Evaluating best management practices by tracking fish population response | 13 |
| 2:45 |  | Kristen Behrens | Regions of genetic divergence in depth-separated Sebastes species pairs: Depth as a potential driver of speciation | 14 |
| 2:55 | Y | Sydney Stark | Evaluating sampling techniques of Flathead Catfish, *Plyodictis olivaris*, in the Susquehanna River Basin for dietary analysis | 15 |

**Plenary Speaker Bio**

**Dr. Prosanta Chakrabarty**

Distinguished Research Chair,

Fulbright Canada, Carleton University, Ottawa

and

Professor/Curator of Fishes

LSU Museum of Natural History

Dr. Prosanta Chakrabarty is a Professor and the Curator of Fishes at the Museum of Natural Science and Department of Biological Sciences at Louisiana State University. He is also a Research Associate at the American Museum of Natural History in New York, Smithsonian’s National Museum of Natural History in Washington, D.C and the Canadian Museum of Nature in Ottawa, Canada. He is a systematist and an ichthyologist studying the evolution and biogeography of both freshwater and marine fishes, his work has taken him to more than thirty countries around the world (including Japan, Australia, Brazil, Taiwan, Madagascar, Panama, and Kuwait). He has described over a dozen new species and published more than 70 peer-reviewed papers and several books. He grew up in New York City, his undergraduate degree is from McGill University in Montreal (the city where he was born) and his PhD is from the University of Michigan. He is a former Program Director at the National Science Foundation, an elected fellow of the American Association for the Advancement of Science, and a TED Senior Fellow. He teaches *Evolution*, and *Ichthyology* at LSU and has given seminars about his work across the country and internationally. He is currently (2020-2021) a Fulbright Distinguished Chair in Environmental Science at Carleton University in Ottawa.

**Oral Presentation Abstracts**

**\* INDICATES A STUDENT PRESENTER TO BE JUDGED**

**Thermal Sensitivity and Resiliency among Coldwater Streams**

Dr. David G. Argenta and Dr. William G. Kimmela

a California University of Pennsylvania, California, PA 15419

The effects of climate change on aquatic biota, particularly those inhabiting coldwater ecosystems, is of increasing concern. Headwater streams harboring populations of Brook Trout (*Salvelinus fontinalis*) will be among the most severely threatened by rising global temperatures. To evaluate the extent of this threat, it is important to understand how such streams respond to changes in ambient air temperature as measured by thermal sensitivity (r), and to what extent those changes impact their resident ichthyofauna.  Since 2011, we have monitored selected headwater streams draining the slopes of Laurel Ridge in southwestern Pennsylvania.  Daily maxima and r values were compared seasonally among selected streams. In addition, fish were sampled from 100-m reaches in 20 streams to characterize resident populations and to determine the impact that thermal sensitivity may have on early developmental stages.  Data suggest that some streams are more thermally stable than others, even during periods of increasing air temperature, and that resident fish populations may experience a wide range of temporal fry emergence patterns.  Protection of riparian cover and groundwater inputs will be critical in maintaining the thermal resilience of headwater Brook Trout streams in a warming climate.

Presenter: Dr. David G. Argent;  [argent@calu.edu](mailto:argent@calu.edu)

**Long-Term flooding impacts in Brook Trout populations in an Appalachian Mountain watershed**

**\***B. Kinga, M.J. Wilsona, D. Resslerb, and J.M. Nilesa

a Freshwater Research Initiative, Susquehanna University, 514 University Avenue, Selinsgrove, PA, 17870

b Earth and Environmental Sciences Department, Susquehanna University, 514 University Avenue, Selinsgrove, PA, 17870

We evaluated the effects of the timing and severity of high flow events on brook trout (*Salvelinus fontinalis*) populations over a 10-year period in the Loyalsock Creek watershed in north-central Pennsylvania. This project focused on 30 headwater streams that share geographic similarities (primarily forested and within the Allegheny Plateau geophysical province). Brook trout population estimates, length, and weight were collected using 3 pass fish collection electrofishing in the same 100-meter sample reach at each stream. For analysis, trout were sorted by age class and linear models were used to compare the effects of site, seasonality, severity, and preceding hydrologic conditions on brook trout biomass, density, and body size response by age class and population. A fall flooding event had a negative impact on fall spawning brook trout. Modeling shows that with climate change the northeast USA will have increased severity and occurrences of fall flooding events. Fall floods that occur post spawn have the potential to wash out brook trout eggs, kill juvenile and small adults, and adversely affect the foraging of exhausted post-spawn adults as they attempt to build biomass heading into winter. As such, climate change driven alterations to flow regime may hinder brook trout populations in this region of the USA.

Presenter: Benjamin King; kingb@susqu.edu

**Real World Examples of a Thermal Fish Index – Based Assessment**

Tim Wertza

aPennsylvania Dept. of Environmental Protection, Harrisburg PA.

Over the past three decades, the Pennsylvania Dept. of Environmental Protection (DEP) has pursued the development of a fish-based stream assessment tool. Historic development attempts identified important factors that played a major role in refining monitoring strategies. As monitoring strategies evolved, the quality and quantity of available data across Pennsylvania’s waterbodies significantly increased. In 2016 another round of developmental efforts was initiated. Guided by previous efforts and supported by over a decade of robust water quality and fish community data, a fish-based assessment tool was developed. The assessment tool uses fish assemblage data to generate a Thermal Fish Index (TFI) score that ranks assemblages from 2.0 to 10.0 along a thermal gradient, coldest to warmest respectively. The TFI based assessment tool (TFI-BASS) uses traditional bioassessment developmental techniques to establish impairment thresholds for making stream assessments of aquatic life use. Implementation of the TFI-BASS supports DEP’s reporting requirements of the federal Clean Water Act (CWA) sections 303(d) and 305(b). The TFI-BASS is considered a novel approach to fish-based bio-assessments when compared to traditional Index of Biotic Integrity-based approaches. It is expected that a review of real-world case studies will aid conceptual understanding and familiarity with the TFI-BASS.

Presenter: Tim Wertz; twertz@pa.gov

**Tools for Passive Acoustic and Video Monitoring of Soniferous Fishes in Western Pennsylvania Lentic Environments**

**\***Daniel Gilliesa

a Post-Baccalaureate in Fisheries and Wildlife Sciences, Oregon State University

Passive acoustic monitoring (PAM) is an underutilized tool with a variety of applications in fisheries biology, such as locating of spawning sites, invasive species monitoring, and for making measurements of ecosystem biodiversity.  While PAM has been established as a research tool for decades, published surveys of freshwater lentic environments remain limited. Furthermore, surveys of lakes and ponds in Western Pennsylvania are even less prevalent, despite the presence of soniferous fish species from families such as *Centrarchidae*, *Ictaluridae*, and *Sciaenidae* that present an accessible target for research. In order to promote the collection of data in these environments, a passive acoustic and video monitoring (PAVM) tool has been designed, utilizing low-cost hydrophones coupled with consumer audio and video recording equipment, that can be easily deployed in lentic freshwater environments by researchers, students, and citizen scientists alike.

In order to aid in the review of PAVM data in Western Pennsylvania, an accompanying web-accessible soniferous species index is in the process of being established. By cross-referencing known or suspected soniferous species with records from fish stocking, biologist reports, individual fishers, and citizen science databases, users of PAVM tools may be able to more easily identify suspected bioacoustic signatures in their recordings. Additionally, by comparing species lists and acoustics data from multiple lentic communities, unidentified bioacoustic signatures may be resolved through comparison of common species and acoustic spectrograms.

Presenter: Daniel Gilles; [gilliesd@oregonstate.edu](mailto:gilliesd@oregonstate.edu)

**Saving fishes from extinction in the United States: a focus on Endangered Species Act recovery plans and expenditures**

Patrick D. Shireya, Susan A. R. Colvinb, Leanne H. Roulsonc, and Thomas E. Bigfordd

a Department of Geology and Environmental Science, University of Pittsburgh, Pittsburgh, PA

b Department of Biological Sciences, Arkansas Tech University, Russellville, AR 72801

c HydroSolutions, Inc., & Department of Ecology, Montana State University, Bozeman, MT

d American Fisheries Society (retired), Silver Spring, MD

Recovery plans under the U.S. Endangered Species Act (ESA) must meet legal requirements to provide recovery time and cost estimates, to set objective and measurable delisting criteria, and to address the five delisting factors that are also considered when listing a species. We review the approaches for setting recovery criteria, evaluate recovery plans for fish listed under the ESA and managed by the Fish and Wildlife Service (FWS) within the U.S. Department of the Interior. Of 105 recovery plans for fish taxa managed by the FWS, 55 plans estimated time to recovery, 46 plans estimated cost of recovery, and 64 plans provided quantitative recovery criteria. We also examine what predicts expenditures for fish species listed under the ESA and managed by FWS. Multiple log-linear regressions on combined state and federal expenditures for listed species for each year from 2014 - 2017 indicated that expenditures varied between FWS regions, and increased with species geographic range and if a species has been litigated or propagated in captivity. The results provide evidence that the recovery priority ranking system does not work as intended - to guide allocation of expenditures for implementing recovery plans.

Presenter: Patrick D. Shirey; [patrickdshirey@gmail.com](mailto:patrickdshirey@gmail.com)

**Difficulty identifying rusty crayfish x Allegheny crayfish hybrids in the Juniata River watershed**

George T. Merovich, Jr.a, Vince Buonaccorsib, Nicolas Smitha, and Madison Hearnb

a Fisheries and Aquatic Sciences Program, Department of Environmental Science, Juniata College, 1904 Moore St., Huntingdon, PA 16652

b Department of Biology, Juniata College, 1700 Moore St., Huntingdon, PA 16652

Rusty crayfish (*Faxonius rusticus*) are invasive in the Juniata River system. They are known to hybridize with congenerics. During our study of crayfish ecology within the Juniata River watershed, we observed individuals that were confusingly intermediate in form, and possible hybrids, between rusty crayfish and another alien species, the Allegheny crayfish (*F. obscurus*). Thus, in the lab we measured morphological and meristic traits of these taxa to quantify differences and to characterize the intermediacy of individuals deemed to be hybrids. In addition, we examined genome-wide single nucleotide polymorphisms from RADseq data of the taxa to identify the origin of putative hybrids. Of the 8 putative hybrids examined for introgression, we found 2 of the individuals to be backcrosses to rusty crayfish. We found 2 of the putative hybrids to be pure Allegheny crayfish, and 4 putative hybrids to be pure rusty crayfish. An individual we classified as rusty crayfish was a hybrid backcross to rusty crayfish. Principal components analysis on 20 morphometric variables across > 300 individuals failed to distinguish the 3 evolutionary lines. Including binary traits in a classification tree analysis showed taxa more distinctly along known lines, with putative hybrids contributing to misclassifications. Thus, we show for the first time that rusty crayfish and Allegheny crayfish hybridize, and that hybrids are very difficult to identify. More work is needed to fully characterize and substantiate this hybridization, its extent, and potential environmental impacts.

Presenter: George T. Merovich, Jr.; [merovich@juniata.edu](mailto:merovich@juniata.edu)

**Nursery habitat characteristics of the invasive, omnivorous Rudd (*Scardinius erythrophthalmus)***

**\***G. M. Herigana, D. P. Craneb, and K. L. Kapuscincskic

a Department of Coastal and Marine Systems Science, Coastal Carolina University, Conway, SC

b Department of Biology, Coastal Carolina University, Conway, SC

c Center for Freshwater Research and Education, Lake Superior State University, Sault Sainte Marie, MI

Understanding habitat use and reproductive biology of invasive species is essential to predicting invasions, designing early detection programs, and developing management plans. The rudd (*Scardinius erythrophthalmus*) is an omnivorous fish native to Europe and western Asia that has been extensively translocated to several countries in western Europe, New Zealand, North America, and Africa. However, little is known about the early life history of rudd, particularly in invaded ecosystems, which limits our ability to predict invasions and create early detection and control programs. The upper Niagara River has the most abundant population of rudd in North America and has been the focus of several ecological investigations. Our study identified critical rearing habitats by determining which nearshore habitat factors were most strongly associated with presence of age-0 rudd. Using logistic regression, we found that emergent vegetation was the most important habitat characteristic associated with the presence of age-0 rudd. However, when emergent vegetation was not present, rudd were more likely to be present at sites closer to wetlands and at sites with abundant submerged aquatic vegetation. These findings can be used to create habitat-driven predictive models of rudd invasion and guide early detection programs for rudd in waters outside their native range.

Presenter: Garrett Herigan; [gmherigan@coastal.edu](mailto:gmherigan@coastal.edu)

**Utilization of Environmental DNA in Monitoring Invasive Northern Snakehead and Blue Catfish in the Lower Susquehanna River**

Aaron Henninga

a Susquehanna River Basin Commission, 4423 N Front St, Harrisburg, PA 17110

The Northern snakehead and Blue catfish are two non-native fish species recently observed in portions of the lower Susquehanna watershed. The Susquehanna River Basin Commission employed environmental DNA (eDNA) sampling as a technique to monitor their spread during 2019 and 2020. Using eDNA as a detection method for invading species allows for a broad geographic area to be screened quickly and focused efforts placed where the species were found.  This method coupled with existing mechanisms for monitoring fish distributions present a unique look at the invasions in progress. The Susquehanna River contains four dams across its lower reaches which are acting as barriers dispersal but with each of these dams also maintaining some form of fish passage facility serving as a possible gateway for range expansion.  Results consistently showed presence of both species below Conowingo Dam although some differences in seasonal distributions was observed between years. The current situation present fisheries managers of multiple jurisdictions with a unique challenge of achieving migratory fish passage while restricting invasive species movements.

Presenter: Aaron Henning; [ahenning@srbc.net](mailto:ahenning@srbc.net)

**Poster Abstracts**

**\* INDICATES A STUDENT PRESENTER TO BE JUDGED**

**Stream Connectivity and Fragmentation Impacts on Wild Trout Populations**

**\***J.C. Millera, M.J. Wilsona, D. Resslera, and J.M. Nilesa

a Susquehanna University, Selinsgrove PA

Stream connectivity promotes resilience and population viability of fish species. Brook trout (*Salvelinus fontinalis*) and Brown trout (*Salmo trutta*) distribution throughout watersheds impacted by aquatic habitat fragmentation have implications for their management and conservation. With wild trout populations being unknown and possibly declining, determining their distributions and linkages in headwater steams is important for conservation. From 2011- 2020 we sampled 1329 previously unsurvey streams in conjunction with the Pennsylvania Fish and Boat Commission. A 100-meter reach was electro-fished to determine the abundance, length (mm), and weight (0.1g) of wild trout species. We used ArcGIS to determine fragmentation (road/railroad crossings, logging roads, gravel roads, impoundments), stream order, link magnitude (the difference between two converging stream orders), watershed size, elevation, slope, and distance to mainstem and how these various parameters impact trout distributions in headwater streams. We sought to determine how headwater streams with natural or anthropogenic fragmentation, steep slopes, and their link magnitude impact wild trout populations within a watershed.

Presenter: J. C. Miller; [millerjc@susqu.edu](mailto:millerjc@susqu.edu)

**Fish biodiversity in the Upper Standing Stone Creek Watershed,**

**Huntingdon County, Pennsylvania**

Logan R. Stengera

a Huntingdon County Conservation District, Huntingdon, PA 16652

Standing Stone Creek is a popular and locally significant high-quality stream that has received considerable conservation and regulatory attention. In 2020, the Huntingdon County Conservation District (HCCD) received a grant to develop a Coldwater Conservation Plan for the Upper Standing Stone Creek watershed. The goal for this project is to 1) collect stream data to assess the current environmental condition of the watershed, 2) establish baseline chemical, physical, and biological stream data to track improvements and/or degradation in the watershed, and 3) address future management, improvement, and conservation strategies. To provide an accurate snapshot of the watershed’s biological health, fish biodiversity surveys were conducted at 11 sites in accordance with Pennsylvania Department of Environmental Protection protocols for fish data collection in wadable streams. In total, 30 species representing 8 families were identified across the watershed, including important socioeconomic species such as trout and smallmouth bass. The presence of a diverse fish community is indicative of excellent water quality and reinforces the need to conserve and protect this system from future degradation.

Presenter: Logan R. Stenger; [stenglr14@gmail.com](mailto:stenglr14@gmail.com)

**Classification of ecological conditions in the Little Juniata River watershed**

**\***Nicholas A. Smitha, Caroline Benfera, and George Merovicha

a Juniata College, Huntingdon, PA

A watershed-scale perspective is needed to effectively manage and conserve fisheries and stream ecosystem health. We surveyed benthic macroinvertebrate communities following rapid bioassessment protocols throughout the Little Juniata River watershed in order to classify ecological conditions. We sampled 33 sites including 14 sites along the mainstem of the river from the headwaters to the mouth and 19 tributaries scattered throughout the watershed in the headwaters and near where they entered the mainstem of the Little Juniata River. We used a rectangular kick net to sample 1 m2 of benthic habitat. We employed the gridding pan subsampling method and identified individuals to the lowest taxonomic classification possible (usually genus). Once identification was completed, we used the abundance data to calculate a suite of typical metrics including the PA Index of Biotic Integrity for wadeable (non-limestone) streams. This allowed us to evaluate and classify the health of streams across the watershed. We found that IBI scores varied widely (16 – 91) from very poor to excellent. As expected, better conditions were found in headwater mountain streams and, surprisingly, the mainstem of the Little Juniata River had very depressed scores (between 16 and 68 for the 14 sites). A multivariate ordination of the genus data confirmed the variably in benthic communities from ones dominated by tolerant taxa to ones more commonly containing sensitive taxa. Future work with these data will allow continuous mapping of conditions at the watershed scale by using landscape modeling techniques. Subsequently, we will be able to identify degraded sites that are priorities for successful remediation, given known features in the surrounding network of streams. These sites will be ones that will be expected to improve quickly given the landscape context within which they occur. A decision support system that employs information at the watershed scale like this will likely increase our ability to successfully manage and improve watershed connectivity and the fisheries they sustain.

Presenter: Nicholas Smith; [smithna17@juniata.edu](mailto:smithna17@juniata.edu)

**Are BMPs effective? Evaluating Best Management Practices by Tracking Fish Population Response**

**\***Kaitlyn Gardineera, Jon Nilesa, Matt Wilsona, and Dan Resslera

a Susquehanna University, Selinsgrove PA

Best Management Practices (BMP’s) are techniques that can be implemented on farms, pastures, and streambanks to decrease the sediment and agricultural chemical pollution that enters waterways. While we know BMPs are generally effective, we would like to know which techniques are most effective for increasing fish populations in agriculture-impaired streams. In our analysis, 36 reference or active stream restoration sites were selected from Centre, Union, Northumberland, and Montour Counties in Central Pennsylvania. BMPs along a 100-m reach were mapped to catalog the type and abundance of techniques implemented or their natural counterparts.  Fish populations were determined by electrofishing and identifying the species of each captured fish. The data was used in multivariate statistics and redundancy analysis (RDA) in the vegan R package to determine trends in fish assemblage response to BMPs abundance. Based on preliminary findings, we expect to see a general increase in fish populations after the implementation of in-stream BMPs (log vanes and mud sills), especially where there is sand and gravel spawning fish, and fish that feed on stream insects (which require high porosity sediments). By the end of our research, along with showing the effectiveness of the implemented BMPs, we hope to come up with a more standardized way to collect and format BMP impacts.

Presenter: Kaitlyn Gardineer; [gardineer@susqu.edu](mailto:gardineer@susqu.edu)

**Regions of genetic divergence in depth-separated *Sebastes* species pairs: Depth as a potential driver of speciation.**

Kristen Behrensa, Dr. Vincent Buonaccorsia, Quinn Giraseka

a Juniata College, Huntingdon, PA

Depth separation is a proposed driver of speciation in marine fishes, with species of marine rockfish (genus *Sebastes*) providing a potentially informative study system. *Sebastes* rockfishes are commercially and ecologically important, encompassing more than one hundred recently diverged species. The ecological and morphological variance between these species provides opportunity for identifying speciation-driving adaptations, particularly along a depth gradient. A reduced representation sequencing method (ddRADseq) was used to compare 96 individuals encompassing six *Sebastes* species. In this study, we sought to identify regions of divergence between species that are indicative of divergent adaptation and reproductive barriers leading to speciation. A pairwisecomparison of *S. carnatus* and *S. chrysomelas* *F*STvalues revealed three major regions of genomic divergence, two of which were also present in the *S. miniatus* and *S. crocotulus* comparison. These corresponded with regions of elevated *D*XY values, suggesting a speciation-with-gene-flow evolutionary model and rather than a model of post-speciation selective sweeps within a single species. A total of 40153 unique loci were found in the *S. carnatus* and *S. chrysomelas* comparison, 32149 unique loci in the *S. miniatus* and *S. crocotulus* comparison, and a total of 54713 unique loci were found in the *S. alutus* and *S. mentella* comparison. Average *F*ST values for each pair were chrysomelas-carnatus (0.0252112), miniatus-crocotulus (0.228873), and alutus-mentella (0.728741). Gene ontology results suggest a potential role of ion transport and temperature adaptations in the divergence of these species. This study provides additional context to the broader picture of how depth separation might arise and how marine species form without distinct geographical influences.

Presenter: Kristen Behrens; [kristenbehrens14@gmail.com](mailto:kristenbehrens14@gmail.com)

**Evaluating sampling techniques of Flathead Catfish, *Plyodictis olivaris,* in the Susquehanna River Basin for dietary analysis**

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Introduced species often alter the community structure of the ecosystems they invade through direct and indirect effects, such as predation and competition. The Flathead Catfish, *Pylodictis olivaris,* is a large piscivorous fish prized by anglers, however the species can alter the structure and function of native aquatic communities when introduced outside its native range. Flathead Catfish were first documented in the Susquehanna River Basin in 2002; however, the effects of this introduction on native and naturalized fish and invertebrate communities are unknown. We initiated a multi-year molecular diet study in 2020 to investigate predatory impacts of Flathead Catfish in the Susquehanna River Basin. Flathead catfish were sampled from July through October in the Susquehanna River using low and high frequency boat electrofishing and baited tandem hoop nets. Out of 161 fish collected, 155 fish were included in our diet analysis and 63 had prey items in their stomachs. Visual analysis of stomach contents revealed that 25 of these samples contained fish, 24 contained crayfish, 6 were mixed crayfish and fish, and 7 had unidentifiable contents. With respect to gear type, Flathead Catfish collected using low and high frequency electrofishing had a higher percentage of stomachs containing prey (53% and 54%, respectively) compared to hoop nets (24%). High frequency electrofishing caught smaller fish (mean ± s.d.; 408± 195mm) when compared to hoop nets (700± 124mm) and low frequency electrofishing (667± 197mm). Molecular analysis of prey items is currently underway to determine which species are preyed upon to understand how Flathead Catfish diets vary temporally and by gear type. Our results suggest electrofishing (both high and low frequency) is more effective than hoop nets for sampling Flathead Catfish for diet collections. A combination of the two techniques would be best for collecting a broader size range, which is critical for understanding potential effects of this species as it continues to spread throughout the Pennsylvania river systems.

Presenter: Sydney Stark; sps6558@psu.edu

**Acknowledgements**

The PA Executive Committee would like to say **THANK YOU** for your attendance at our 2021 Virtual Technical Meeting and for your support throughout the year. It has been a busy year of virtual conferences and meetings. We wish to thank all presenters for *Adapting to Change* and braving yet another virtual professional conference in order to communicate important research findings to the fisheries and aquatic science community. We look forward to seeing everyone again next year.

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**2021 Summer Social**

**Raystown Field Station**

**Saturday, July 17, 2021**

Lunch at Noon**:** Please bring a covered dish or dessert

**Business Meeting at 3 PM**

With introduction of new officers

**[14322 Field Station Lane, Entriken PA 16638](https://goo.gl/maps/WbAw9w2zLdRePMo78)**

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**Fun for the whole family by the lake!**

Come early. Stay late. Hiking, canoeing, kayaking, fishing, fish sampling, swimming, sightseeing, and conversation.

For more information about the event contact: **George Merovich** at [MEROVICH@ Juniata. edu](mailto:MEROVICH@Juniata.edu)  To learn more about the Juniata College Field Station visit: [www. Juniata. edu/offices/field-station](http://www.juniata.edu/offices/field-station)



**Notes**