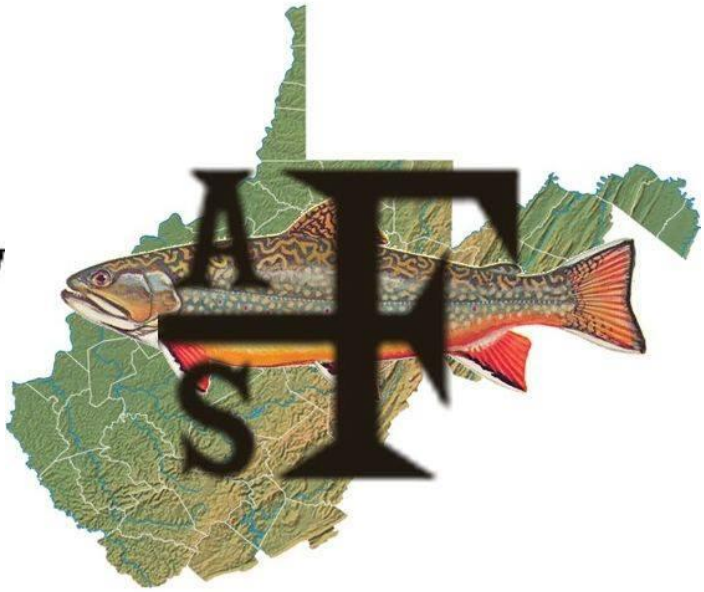
2017 Technical Meeting



The Pennsylvania and West Virginia Chapters of the American Fisheries Society

February 9th & 10th, 2017

Hosted by California University of Pennsylvania

Convocation Center

California, Pennsylvania

Time		
8:00 AM	**Welcome and introductions:** Jordan Allison and David Thorne	
8:15 AM	**PLENARY:** Rob Criswell. Rob is retired from the PA Game Commission where he served as the Southcentral Regional Manager. He is an avid photographer and conservation biologist. He was past president of the PA Biological Survey for some time and currently sits on the Fishes Technical Committee. Rob's most recent accomplishment was co-authoring the Fishes of Pennsylvania book along with Jay Stauffer and Doug Fischer. You can learn more about Rob by visiting his website https://robcriswellphoto.wordpress.com/tag/fishes-of-pennsylvania/	
	Session A	**Session B**
	FISH HEALTH	**FISHERIES TECHNOLOGY**
8:45 AM	**Vicki Blazer -** A decade of monitoring health of bass in the Chesapeake Watershed - What have we learned and where are we headed?	**Alan Temple** - Estimating effective water conductivity ranges for four backpack electrofisher models
9:05 AM	**Cheyenne Simpson -** Immune function in Smallmouth Bass (Micropterus dolomieu) plays a role in susceptibility to pathogens and infections within the Potomac and Susquehanna River basin regions of the Chesapeake Bay watershed	**Kyle Hartman** - Seeing underwater through sound
9:25 AM	**Ryan Braham -** Associations among estrogenic activity, select chemical compounds and microcystin toxins at select sites in the Potomac River drainage, USA	**Cory Hartman** - Estimating percent based proximate composition of Brown Trout (Salmo trutta) through Bioelectrical Impedence Analysis (BIA)
9:45 AM	**Heather Walsh -** Pathology and risk factors associated with young-of-year Smallmouth Bass (Micropterus dolomieu) mortality in the Susquehanna River basin, Pennsylvania	**Gregory Moyer** - Applications of environmental DNA methods for inventory and monitoring of aquatic species
10:05 AM	**Megan Kepler Schall** - Investigating trends in riverine Smallmouth Bass catch per effort data in Pennsylvania	**Austen Rizzo** - Development of Techniques for Assessment of Population Characteristics of the Diamond Darter
10:25 PM	**BREAK**	
	SPORT FISH MANAGEMENT	**SALMONID ECOLOGY**
10:40 AM	**David Thorne** - Crayfish as a component of the diet of stocked trout in southern West Virginia	**Shannon White** - Movers and stayers: Can we predict movement behavior in Brook Trout?
11:00 AM	**Aaron Cushing** - Managing multiple non-reproducing predator species in a small West Virginia impoundment	**Brandon Hoenig** - DNA-based dietary analysis to investigate niche partitioning among native and naturalized salmonid species in a western Pennsylvania stream
11:20 AM	**Mike Depew** - Sampling and population characteristics of catfish in Pennsylvania	**Aiden Simpson** - Network analysis as a prioritization tool for identifying survey sites on unassessed waters
11:40 AM	**Robert Carline** - Hooking and Handling Mortality of Trout Captured in the Bald Eagle Creek Tournament	
12:00 PM	**LUNCH**	
	SALMONID ECOLOGY	**IMPAIRED WATERS**
1:20 PM	**Eric Merriam** - Resiliency of meso-scale thermal habitats and regfugia within an Appalachian riverscape	**Wellman** - Recovery of a fish assemblage following a unique fish kill in a tributary of the Monongahela River
1:40 PM	**Ben Harris** - Brook and Brown Trout movement in a restored Appalachian watershed	**Rick Lorson** - Dunkard Creek pollution event: Restoration status of the quality sport fish populations
2:00 PM	**Ross Andrew -** Brook Trout Population Growth and Synchrony in the Central Appalachians	**Erika Bendick** - Lower Dunkard Creek: An assessment of water quality and biology
2:20 PM	**Patrick Shirey** - Merging Ecology, History, and Law to Conserve Brook Trout in the Wild and Scenic Namekagon River, Wisconsin, USA	**Whitney Peters** - Beech Creek invertebrates
2:40 PM	**Harvey Katz** - The bogs of Loyalsock State Forest	**Dustin Smith** - Recovery of a reservoir fish community from acidification
3:00 PM	**BREAK**	
3:15 PM	**End of Technical Session**	
3:30 PM	**Parent Society Update- Dr. Doug Austin**	
3:45 PM	**WV Chapter Business Meeting (Room A)**	**PA Chapter Business Meeting (Room B)**
	Student - Mentor Session (Room C)	
4:45 PM	**BREAK FOR DINNER ON YOUR OWN**	
6:00 PM		

3:15 PM	End of Technical Session	
3:30 PM	Parent Society Update- Dr. Doug Austin	
3:45 PM	WV Chapter Business Meeting (Room A)	PA Chapter Business Meeting (Room B)
	Student - Mentor Session (Room C)	
4:45 PM	BREAK FOR DINNER ON YOUR OWN	
6:00 PM		
9:00 PM	Poster Session Social	

	Friday, 10th
8:00 AM	Opening Remarks
8:15 AM	Fish Health Investigations: An introduction to Field Methodologies and Emerging Techniques Session 1 (Room A)
	Conservation, Ecology and Identification of Mid-Atlantic Crayfishes Session 1 (Room B)
	Introduction to R and techniques for analysis of ecological communities Session 1 (Room C)
10:00 AM	BREAK
10:15 AM	Fish Health Investigations: An introduction to Field Methodologies and Emerging Techniques Session 2 (Room A)
	Conservation, Ecology and Identification of Mid-Atlantic Crayfishes Session 2 (Room B)
	Introduction to R and techniques for analysis of ecological communities Session 2 (Room C)
12:00 PM	Workshop Wrap-up

Abstracts

Technical Session #1 – Breakout Session A

(Room A)

“Fish Health”

Thursday, February 9th

8:45 AM – 10:25 AM

$ - Eligible for best student presentation

A Decade of Monitoring Health of Bass in the Chesapeake Watershed – What have we learned and where are we headed?

Vicki S. Blazer[1], Heather L. Walsh[2], Luke Iwanowicz[1], Geoffrey Smith[3], Jim Hedrick[4], Brandon Keplinger[4] and John Mullican[5]

[1]U.S. Geological Survey, National Fish Health Research Laboratory, Kearneysville, WV [2]West Virginia University, Morgantown, WV [3]Division of Fisheries Management, Pennsylvania Fish and Boat Commission [4] West Virginia Division of Natural Resources [5]Maryland Department of Natural Resources

Since 2003, in the Potomac drainage, fish kills and a high prevalence of adult bass with skin lesions has attracted raised concerns with the public and management agencies. In addition during attempts to better understand these mortalities histopathological analyses demonstrated a high prevalence of intersex or testicular oocytes at many sites throughout the Potomac drainage. Since 2005, mortalities and external lesions of young-of-year (YOY) smallmouth bass in the Susquehanna drainage, as well as skin lesions such as melanistic areas have raised similar concerns. A high prevalence of intersex has also been observed in the Susquehanna. Studies over many years have shown both adult and YOY involved in mortality events may have multiple bacterial infections, the presence of largemouth bass virus and heavy trematode and myxozoan parasite infections. No one pathogen is consistently observed or cultured, suggesting immunosuppression, allowing opportunistic infections. Signs of exposure to chemicals include testicular oocytes, plasma vitellogenin in male bass and oxidative damage. Studies have involved comparisons of sites with varying land use, as well as multi-year monitoring to better understand climatic-related factors such as flow and temperature. What has been learned from these studies will be presented. In addition, the results of new approaches including gene expression, immune function assays and long term monthly and storm sampling of chemicals of emerging concern will be presented.

Immune function in smallmouth bass (*Micropterus dolomieu*) plays a role in susceptibility to pathogens and infections within the Potomac and Susquehanna River Basin regions of the Chesapeake Bay Watershed

Cheyenne Simpson[1,2], Christopher Ottinger[1], Vicki Blazer[1], and Luke Iwanowicz[1]

[1]U.S. Geological Survey, National Fish Health Research Laboratory, Kearneysville, WV [2]West Virginia University, Morgantown, WV

The Potomac and Susquehanna Rivers, both tributaries to the Chesapeake Bay, have been sites that have experienced fish kills and a high prevalence of visible lesions. This has concerned management agencies as well as the public. Previous fish health investigations have indicated smallmouth bass (*Micropterus dolomieu*) from both river basins to have a variety of bacterial infections, heavy parasite loads and sometimes viral and fungal infections. This leads us to believe the fish are immunosuppressed, causing them to be susceptible to many opportunistic pathogens. Anterior kidney tissue, the main hematopoietic tissue in fish, was collected from smallmouth bass at four affected sites with varying levels of agricultural or wastewater input within the Potomac and Susquehanna River basins. Samples from all four sites were collected across two sampling seasons. Anterior kidney leukocytes were isolated from the tissues and level of immune response on the cellular level was assessed. Utilizing new methods and techniques, we looked at bactericidal killing ability, respiratory burst activity, and lymphocyte proliferating ability. The study is still ongoing, but the preliminary results and significance of these analyses will be discussed.

. *$* Associations among estrogenic activity, select chemical compounds and microcystin toxins at select sites in the Potomac River drainage, USA

Ryan P. Braham[1], Vicki S. Blazer[2], Luke R. Iwanowicz[2], Patricia M. Mazik[3], and Michael T. Meyer[4]

[1]School of Natural Resources, West Virginia University, Morgantown, WV [2]U.S. Geological Survey, National Fish Health Research Laboratory, Kearneysville, WV [3]West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown, WV [4]U.S. Geological Survey, Kansas Water Science Center, Lawrence, KS

We sampled 15 sites distributed among the middle and upper Potomac River watershed that were identified based on land cover/land use characteristics, as well as historic mortality and disease events in fishes within the watershed. Sites were sampled once- or bi-monthly from June 2013 through December 2015. Samples were pre-screened using the bioluminescent yeast toxicity screen (BLYR). Samples which were not determined to be toxic were quantified as total 17β-estradiol equivalency (EEQ; ng/L) using the bioluminescent yeast estrogenicity screen (BLYES). These EEQ data were compared with concentrations of total microcystins (ng/mL), as well as the phytoestrogens equol and formonentin (ng/L) at select sites. 83% of samples analyzed had quantifiable estrogenic activity, however these concentrations were relatively low (97% were below 1.0 ng/L EEQ). We did not observe a gradient along the downstream continuum; however overall we did observed both seasonal and annual differences. The seasonal variability among EEQ positively correlates with both the total microcystins and the concentrations of equol and formonentin. This suggests a contribution of instream estrogenicity from terrestrial plant-derived sources. This also invokes the question of the contribution from the cyanobacterial community. We believe these data elucidate the importance of long-term temporal monitoring, as well as the need for understanding the effects of chronic, sub-lethal concentrations of endocrine disrupting compounds.

$ Pathology and Risk Factors Associated with Young-of-Year Smallmouth Bass *Micropterus dolomieu* Mortality in the Susquehanna River Basin, Pennsylvania

Heather L. Walsh[1], Vicki S. Blazer[2], Geoffrey Smith[3], Adam J. Sperry[2] and Kelly L. Smalling[4]

[1]West Virginia University Research Corporation, Morgantown, WV [2]U.S. Geological Survey, National Fish Health Research Laboratory, Kearneysville, WV [3]Division of Fisheries Management, Pennsylvania Fish and Boat Commission, Harrisburg, PA [4]U.S. Geological Survey, New Jersey Water Science Center, Lawrenceville, NJ

Evidence of disease and mortalities of young-of-the-year smallmouth bass *Micropterus dolomieu* (YOY SMB) has been occurring during the summer throughout the Susquehanna River watershed since 2005. Fish were examined grossly and histologically for abnormalities and tissue contaminant concentrations were determined from whole body homogenates. External signs of disease included red, eroded lesions, discrete, raised areas predominantly in the caudal area and creamy white raised areas. Observed or isolated pathogens included bacteria, predominantly *Aeromonad* spp., *Flavobacterium columnare*, and *Plesiomonas shigelloides*; parasites, including cestodes, trematodes, and the myxozoan *Myxobolus inornatus*; and largemouth bass virus. Although these pathogens were found in YOY SMB from multiple sites, none were consistently found or associated with all incidence of disease. Histopathological alterations included skin necrosis and inflammation, which in some instances exposed bone. Additionally, a systemic infection resulting in diffuse granulomatous inflammation in the liver, spleen, intestines, choroid of the eye and around the spinal cord were observed innumerous YOY SMB from the mainstem sites. Major pathological alterations resulting from parasite infection included focal granulomas in the skin and muscularis of the gut, inflammation and necrosis in the liver from trematode metacercariae, and skin perforations caused by *Myxobolus inornatus*. A number of chemicals were detected from the tissues of YOY SMB, including several PCB congeners, organochlorine and current use pesticides and brominated diphenyl ethers. Parasites, bacteria, and contaminants have been shown in multiple other studies to have serious implications on the ability of the teleost immune system to function properly. The findings in this study uphold initial assumptions that there is no single cause for disease and mortalities in YOY SMB; rather it is likely the synergistic effect of these stressors that suppress immune function and incapacitate these fish to cope with opportunistic pathogen during a sensitive developmental life stage.

$ Investigating trends in riverine smallmouth bass catch per effort data in Pennsylvania

Megan K. Schall[1,2] , T. Wagner[3], R. M. Lorantas[4], G. D. Smith[4], and V.S. Blazer[5]

[1] Intercollege Graduate Degree Program in Ecology, Pennsylvania State University [2] Pennsylvania Cooperative Fish and Wildlife Research Unit, Pennsylvania State University

[3] U.S. Geological Survey, Pennsylvania Cooperative Fish and Wildlife Research Unit, Pennsylvania State University [4] Pennsylvania Fish and Boat Commission [5] U.S. Geological Survey, Fish Health Research Laboratory,Kearneysville,WV.

Smallmouth bass *Micropterus dolomieu* in Pennsylvania are an important recreational fish species. However, smallmouth bass in the Susquehanna River and its tributaries have been documented to have clinical signs of disease, intersex, mortality, and reported declines in catch rates have occurred since 2005. Other major rivers including the Delaware and Allegheny rivers have not had similar fish health concerns. The goal of this research was to compare temporal trends in catch rates of smallmouth bass from major rivers or river sections in the state, including the Susquehanna River Basin, and to consider these trends within the context of the timing of disease events. We used fishery survey data collected by Pennsylvania Fish and Boat Commission and dynamic linear models to quantify trends and to estimate annual probabilities of decline in catch per unit effort for major rivers and river sections in the state from 1990 to 2011. Periods of declines in catch rates for total catch (all sizes of fish sampled) were present in most rivers or river sections, but were most pronounced in the Susquehanna River Basin. Within the Susquehanna River Basin there was variability in the timing, duration, and magnitude of declines with trends beginning to stabilize towards the end of the time series. Declines in catch rates throughout the Susquehanna River Basin began prior to the observation of overt disease outbreaks in all rivers and river sections evaluated. The Delaware and Allegheny rivers did not have similar trends, although the Allegheny River did have a period of decline beginning towards the end of the time series. When the analyses were restricted to fish greater than 375mm in length, trends in catch rates were increasing or stable across all rivers and river sections for the majority of the time period evaluated. Evaluation of trends in catch per unit effort data provides insight for both researchers and managers regarding the dynamics of the fishery and how this relates to changes in environmental conditions as well as management needs of the system.

Abstracts

Technical Session #1 – Breakout Session B

(Room B)

"Fisheries Technology"

Thursday, February 9th

8:45 AM – 10:25 AM

Estimating Effective Water Conductivity Ranges for Four Backpack Electrofisher Models

Alan Temple US Fish and Wildlife Service, NCTC Shepherdstown, WV

There are several considerations when selecting electrofishing gear. One important factor is the range of water conductivity the unit can efficiently sample. Effective range is the span of water conductivity wherein the electrofishing unit can output the required amount of power for successful sampling. Effective water conductivity ranges of four backpack models were estimated in the lab under a simulated ambient water conductivity interval of approximately 15 µS/cm – 11,538 µS/cm. Waveforms applied were pulsed direct current (PDC), 60 pps, and either 15%, 20%, 25%, or 30% duty cycle. Maximum outputs (volts, amps, power) at a given water conductivity were measured and compared to power required based on the power transfer model and unpublished data collected during electrofishing classes in small, shallow streams. Effective range of conductivity narrowed with increasing duty cycle. For a PDC, 60 pps, 25% duty cycle waveform, the estimated effective conductivity ranges were:

Infinity Xstream (Midwest Lake Electrofishing Systems):	15 – 2,600 µS/cm
LR-24 (Smith-Root, Inc.):	18 – 810 µS/cm
ABP-3 (ETS Electrofishing Systems, LLC.):	33 - 660 µS/cm
Model 12-B POW (Smith-Root, Inc.):	40 – 315 µS/cm

Seeing underwater through sound

Kyle J. Hartman and Cory M. Hartman

Wildlife & Fisheries Resources Program, West Virginia University, Morgantown, WV

Sound has been used since the 1940's by the military to monitor the oceans for potential threats. However the transfer of this technology to fisheries applications lagged behind. In the 1970's sonar was being used to estimate stock sizes of marine and Great Lakes fishes but much of the data contained in the "pings" was lost. Recent advances in software have made it possible to track individual fish and allow the "acoustician" to estimate abundance, sizes, and size structure of schools and individuals. Most of these applications rely on a single sonar frequency. However multi-beam systems have become available that allow fisheries personnel to view under the water with images and video often as crisp as modern natal ultrasounds. In this talk we show examples of these sounding devices and show some of the uses and things we have captured while using sound to study fishes in systems ranging from the Monongahela and Ohio Rivers to the Hudson River and lakes in Alaska. Our goal is to spark interest in the fisheries community for how such technology might help answer questions of management concern.

$ Estimating Percent Based Proximate Composition of Brown trout (*Salmo trutta*) through Bioelectrical Impedance Analysis (BIA)

Cory M. Hartman and Kyle J. Hartman

Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV

The need to precisely measure growth is common in many fisheries studies. Growth measures other than total masses or lengths are nearly nonexistent because more precise measurements such as body composition analysis are often too difficult and time consuming. To overcome this challenge in fisheries research, bioelectrical impedance analysis (BIA) is developing into a low-cost tool providing accurate estimates of fish condition. Past researchers have been able to predict both mass-based and the preferred percent-based proximate composition estimates. The objective of this study was to create a means of estimating condition in Brown trout (*Salmo trutta*) by way of percent dry weight (PDW) based body composition. Resistance, reactance and detector length data was collected from 42 Brown Trout using two measurement locations: dorsal total length (DTL) and ventral pre-dorsal fin (DTVPre); using a tetrapolar Quantum II bioelectrical impedance analyzer (RJL Systems, Detroit, Michigan). Each measurement was taken using 2 sets of electrode pairs consisting of needles protruding 3mm and spaced 10mm apart. Step wise regressions were then run in SAS 9.3 to predict PDW from a suite of predictor variables. Stepwise regression retained any variables significant at α=0.05 level. The best fit models at all three temperatures were linear with significant relationships at 8.4^{o}C (R^2>0.49) and 12.5^{o}C (R^2>0.67). The strongest relationship was at 20^{o}C (R^2>0.73) with a predictive model of: PDW=11.5257+ (0.06359*DTL Parallel reactance index) + (0.08802*DTVPre Resistance). Estimation of body composition using bioelectrical impedance analysis will allow for increased precision in bioenergetics energy flow and monitoring of overall health of Brown Trout populations in response to global climate change not previously possible. More experimentation is needed for all sizes of brown trout to fully explain the variation that size has on measurements taken.

Applications of environmental DNA methods for inventory and monitoring of aquatic species

Gregory R Moyer, Department of Biology, Mansfield University, Mansfield PA

Environmental DNA (eDNA) is nuclear or mitochondrial DNA that is released from an organism into the environment. For small, rare, secretive, and other species that are difficult to detect, eDNA provides an attractive and often cost effective alternative for aquatic inventory and monitoring (I&M) programs. Thus, detection of species using eDNA may improve biodiversity assessments and provide information about status, distribution, and habitat requirements for lesser-known species. My talk will discuss some of the pros and cons of eDNA methodology and conclude with several examples of ongoing research utilizing eDNA for aquatic invasive species I&M and a comparisons of back-pack electrofishing vs eDNA detection methods.

Development of Techniques for Assessment of Population Characteristics of the Diamond Darter

$ **Austin Rizzo**[1], Stuart Welsh[2], Donald Brown[1, 3], and Patricia Thompson[1]

[1]Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV [2]USGS, West Virginia Cooperative Fish and Wildlife Research Unit, Morgantown, WV [3]USFS, Northern Research Station, Parsons, West Virginia

Population monitoring is an essential component of endangered species recovery programs. The federally endangered Diamond Darter *Crystallaria cincotta* is in need of an effective monitoring design to improve our understanding of its distribution and track population trends. To accomplish this, research is needed to determine if survey efforts can be improved by increasing the probability of detection. The primary objective of this study was to determine if there are seasonal and diel patterns in Diamond Darter detectability during population surveys. In addition to temporal factors, we also assessed habitat variables that might influence detection. We used *N*-mixture models to estimate site abundances and relationships between covariates and detectability. The results of this study will allow researchers and agencies to maximize detection probability when surveying populations, resulting in greater monitoring efficiency and likely more precise abundance estimates. Length measurements are an integral part of age/length data used for fish population studies. For those species that are rare, threatened, or endangered, using a nonintrusive method to obtain measurements may be imperative in allowing for continued study of the organism. We used photogrammetric techniques to obtain length measurements of the Diamond Darter. We also evaluated the photogrammetric technique on two surrogate darter species, where total length and body length were obtained from direct and photogrammetric measurements. Together these projects have been useful in the assessment of the population characteristics of the Diamond Darter. This information will be beneficial for future management and conservation efforts of this federally endangered fish.

Abstracts

Technical Session #2 – Breakout Session A

(Room A)

"Sport Fish Management"

Thursday, February 9th

10:40 AM – 12:00 PM

Crayfish as a component of the diet of stocked trout in southern West Virginia

David Thorne[1], Jim Hedrick[1], Craig Stihler[1], and Zach Loughman[2]

[1]West Virginia Division of Natural Resources, [2]West Liberty University

Recent listings of the endangered Guyandotte River Crayfish *Cambarus veteranus* and the threatened Big Sandy Crayfish *Cambarus callainus* have jeopardized continuation of the local seasonal stocked trout fisheries in the waters where these crayfish occur. Concerns were raised by the US Fish and Wildlife Service requiring a "Section 7 review" as mandated by the Endangered Species Act to determine the impact of continued stocking of hatchery-reared trout in waters where populations of the two crayfish are known to occur. A stream with carry-over Rainbow Trout *Oncorhynchus mykiss* and Brown Trout *Salmo trutta*, as well as native Smallmouth Bass *Micropterus dolomieu* and other non-imperiled crayfish of the genera *Cambarus* and *Orconectes*, was identified for use as a surrogate for conducting a diet study to determine the comparative utilization of crayfish in the diets of sport fishes. Results indicated that Rainbow Trout (n=31) had an occurrence of crayfish in 0.9% of their diet, while Brown Trout (n=2) utilized crayfish as 18.2% of their diet, and Smallmouth Bass (n=5) had a 60% occurrence of crayfish in the diet. Based on these results, the US Fish and Wildlife Service has issued a letter of concurrence with our request to continue with seasonal trout stockings in the streams with *C. callainus* and *C. veteranus* provided that Rainbow Trout were the exclusive species used to sustain the put-and-take fisheries.

Managing Multiple Non-Reproducing Predator Species in a Small West Virginia Impoundment

Aaron Cushing[1], David Beasley[1], Vic DiCenzo[1]

[1] SOLitude Lake Management, Virginia Beach, VA

The opportunity for anglers to routinely catch trophy fish is slowly improving thanks to the progression of management techniques in the private pond management industry. One waterbody in particular, a 7.5-acre pond in West Virginia, has been methodically transitioning from a predator-heavy, out-of-balance fishery, into one that has a great chance of exceeding fishery objectives. In the spring of 2013, an initial electrofishing study indicated a stunted bass population, poor water quality, and an insufficient forage base required to meet the goals of a trophy fishery. The pond was drained and reset prior to improvements including the addition of open water artificial underwater reefs, the installation of an aeration system, fish feeders, and limestone gravel placed throughout the pond to improve water quality and serve as spawning substrate. Later in the first season the forage base was re-established. In the fall of 2014, Tiger Muskie (*Esox masquinongy* X *Esox Lucius*) were stocked and in the spring of 2015 female Largemouth Bass (*Micropterus salmoides*) and Hybrid Striped Bass (*Morone chrysops x Morone saxatilis*) were stocked, with the goal of maintaining control over the number of predators that exist by stocking sterile hybrids and only female Largemouth Bass. One year later, a diverse forage base is thriving and the recaptured Largemouth Bass grew an average of 162 mm (6.4 inches) and 862 g (1.9 pounds) in 14 months with a mean relative weight (Wr) of 116. Hybrid Striped Bass averaged 173 mm (6.8 inches) in growth and 862 grams (1.9 pounds) in 14 months with a mean Wr of 82. Tiger Muskie averaged 330 mm (13.8 inches) and 1451 grams (3.2 pounds) with a mean Wr of 86 over 19 months. With non-reproducing predators and the proper foresight from a professional who shares the same vision as the owner, this fishery has an opportunity to routinely produce trophy-caliber fish.

Sampling and Population Characteristics of Catfish in Pennsylvania

Mike Depew[1] and Rick Lorson[1]

[1] Fisheries Management Area 8, Pennsylvania Fish and Boat Commission, Somerset, PA

Channel Catfish (*Ictalurus punctatus*) and Flathead Catfish (*Pylodictis olivaris*) are increasingly popular sportfishes in Pennsylvania with over 20% of licensed anglers fishing for catfish species each year. Due to the increase in popularity, the *Strategic Plan for Management of Channel and Flathead Catfish in Pennsylvania* (Plan) was recently drafted by the Pennsylvania Fish and Boat Commission with the purpose to address catfish management in Pennsylvania. Historically, fisheries managers in Pennsylvania have used traditional gear (trap nets) to sample catfish populations. However, little to no information existed on the effectiveness of other sampling techniques as well as characteristics (age, growth, and survival/mortality) of catfish populations in Pennsylvania. As part of the *Plan ,* Fisheries Management personnel used tandem baited hoop nets to gather standard catch rates for catfish throughout the state in both lotic and lentic systems. Otoliths were removed from catfish to facilitate aging and determine growth and mortality rates. Preliminary results indicate wide variability in catch rates for tandem baited hoop nets, with lotic systems tending to have higher catch rates. Age determination from otoliths have yielded Channel Catfish up to 30 years old and Flathead Catfish up to 33 years old in study waters, with a wide range of ages throughout the state. Many of the oldest fish were found from the Three Rivers system of Western Pennsylvania. Growth rates for catfish varied by water and were generally lowest in the Three Rivers system. Total annual mortality rates for catfish were lowest in the Three Rivers system and were higher in study lakes. Total annual mortality rates were lower than 50% for all study waters, suggesting the majority of waters have low exploitation of the catfish populations.

Hooking and Handling Mortality of Trout Captured in the Bald Eagle Creek Tournament

Robert F. Carline[1], Mark F. Jackson and Mark A. Nale[2]

[1] U.S. Geological Survey, retired, [2] Bald Eagle Sportsmen's Club

In April 2014, 2015, and 2016, we quantified hooking and handling mortality of stocked trout caught with a variety of terminal tackle during a 2-d tournament on Bald Eagle Creek, central Pennsylvania. Each year we affixed Floy tags to 760 trout and stocked them in an 11-km stream reach. All tagged trout that were alive when checked in were eligible for cash prizes. After processing, trout were monitored for 10 d in a hatchery. Anglers brought in 423 to 591 tagged trout each year. Trout were caught on natural baits and Power baits (88.0%), artificial lures (10.6%) and flies (1.5%). Mortality ranged from 4.1% to 7.7%. Among years, 74% of the mortalities occurred on the day of capture. Trout that were brought in with hooks embedded in them had a higher mortality (13.6%) than did those without hooks (4.5%). Neither time from capture to check in, holding method, hook type, nor hook size influenced mortality. This study demonstrated low mortality of trout that were caught primarily with bait and subjected to more handling stress than they would normally experience in catch-and-release waters. We suggest that these results support the notion that bait fishing is compatible with the intended goals of special regulation waters such as catch-and-release and delayed harvest.

Abstracts

Technical Session #3 – Breakout Session B

(Room B)

"Salmonid Ecology I"

Thursday, February 9th

10:40 AM – 11:40 AM

Movers and Stayers: Can We Predict Movement Behavior in Brook Trout?

$ **Shannon White**[1] and Tyler Wagner[2]

[1] Pennsylvania Cooperative Fish and Wildlife Research Unit, Pennsylvania State University
[2] U.S. Geological Survey, Pennsylvania Cooperative Fish and Wildlife Research Unit, Pennsylvania State University

Despite decades of research, the cause of individual differences in trout movement behavior remains unknown. In particular, models characterizing movement as a function of habitat quality or fish phenotype fail to fully explain the leptokurtotic distribution that describes the movement behavior of many salmonid populations. This suggests that movement may be a physiological property with genetic control. We completed a multi-season movement study of native brook trout populations in the Loyalsock Creek watershed, Pennsylvania to determine whether movement can be predicted by fish genotype. Using radio telemetry, we tracked the movements of 166 brook trout in the three tributaries to Loyalsock Creek in 2016. A blood sample and gill biopsy was taken from each tagged fish multiple times throughout the study for genomic sequencing and to measure temporal variation in gene expression. We found high individual variability in movement behavior with the majority of fish remaining sedentary during summer, but some individuals dispersing several kilometers after spawning. We will continue exploring genetic correlates to movement and quantify environmental variables that many influence movement. As mobile individuals are less susceptible to the lethal effects of local habitat loss and maintain population connectivity, this study could have implications for trout conservation and management.

DNA-based dietary analysis to investigate niche partitioning among native and naturalized salmonid species in a Western Pennsylvania stream

$ **Brandon D. Hoenig**[1], Brian K. Trevelline[1], Timothy J. Nuttle[2], Steven C. Latta[3], and Brady A. Porter[1]

Duquesne University[1], Civil & Environmental Consultant Inc.[2] National Aviary[3]

Interspecific competition between native and introduced salmonids has been indicated as a negative factor that can drive the decline of native trout populations. While previous studies have attempted to identify salmonid prey items morphologically, the use of DNA-based prey identification has not yet been utilized to examine these complex food webs with high taxonomic resolution. We have developed and tested a technique that employs gastric lavage and subsequent DNA-based identification of stomach contents to describe the arthropod diets of three coexisting salmonid species, the introduced Brown and Rainbow trout, and the native Brook trout. Preliminary findings indicate that these three trout species coexist in naturally reproducing populations in Powdermill Run in Rector, PA, but community structure and demography varies by stream section. Our preliminary results indicate that, while these competing trout share prey items, including many pollution-sensitive EPT taxa, some dietary items could be unique to specific trout species. These results indicate that dietary and spatial resource utilization is partially shared, but trout may adjust their niches to reduce interspecific competition and maintain stable populations. As our methodology utilizes non-lethal collection techniques, trout populations can be sampled multiple times each year to examine seasonal dietary preferences with minimal population impact. This study also provides a new approach to understanding niche overlap with molecular methods in an effort to provide a greater taxonomic resolution of salmonid diet. Our findings illustrate the importance of coupling traditional field techniques and molecular analyses for understanding aquatic trophic interactions.

N**etwork analysis as a prioritization tool for identifying survey sites on unassessed waters**

Aiden Simpson[1] and Robert Weber[2]

[1] Western PA Conservancy [2]PA Fish & Boat Commission

Fisheries biologists from WPC and PFBC incorporated network analysis into the state unassessed waters initiative's prioritization of future surveys. A current wild trout dataset was combined with instream temperature modeling to construct a wild trout movement network to base predictions on. From 2016 data, streams highlighted using network analysis were more likely to accurately predict wild trout presence, and accounted for the majority of high priority streams documented. Results suggest that network analysis may be useful in future efforts to prioritize and quantify efforts to assess and conserve wild trout populations.

Abstracts

Technical Session #4 – Breakout Session A

(Room A)

"Salmonid Ecology II"

Thursday, February 9th

1:20 PM – 3:00 PM

Resiliency of meso-scale thermal habitats and refugia within an Appalachian riverscape

Eric R. Merriam, J. Todd Petty, Nicolas Zegre, Rodrigo Fernandez

Efforts to characterize vulnerability or resiliency of thermal habitats at the meso-scale (sub-watershed or stream network) have been limited due to a lack of long-term data. We provide such an assessment for the upper Shavers Fork sub-watershed in West Virginia, which supports one of only a few known brook trout (*Salvelinus fontinalis)* metapopulations. We assessed spatial and temporal (2001–2015) variability in summer (6/1–8/31) mean daily stream temperatures (T_S) across 23 (9 tributary, 14 main-stem) reaches. We then developed a mixed effects model to predict site-specific mean daily T_S from air temperature (T_A) and discharge (Q). Finally, we coupled future climate data with a hydrologic model to predict future (2016–2100) changes in T_S under 2 climate scenarios [RCP 4.5 (low emissions) and 8.5 (high emissions)]. Observed annualized mean daily T_S never exceeded the 21^{o}C ecological threshold for brook trout. However, we observed daily T_S> 21^{o}C in all but one main-stem site. We modeled mean daily T_S with a high degree of certainty (R^2=0.93; RMSE=0.76^{o}C). Mean daily T_S was predicted to increase across main-stem [0.2 (RCP 4.5) and 1.2^{o}C (RCP 8.5)] and tributary [0.3 and 1.2^{o}C] sites under both scenarios. However, annualized mean daily T_S never exceeded 21^{o}C under either scenario due to increased Q offsetting increased T_A. The number of days with mean T_S >21^{o}C increased under both scenarios, suggesting increased risk for thermal stress. Main-stem reaches immediately below major tributaries had lower observed and predicted mean daily T_S compared to neighboring reaches and rarely exceeded 21^{o}C under either scenario, offering potential refugia during current and future periods of high T_S. Our results suggest thermal habitats in many Appalachian riverscapes may be more resilient than previously thought, enabling persistence of brook trout populations and important life history processes occurring at the meso-scale.

$ **Brook and brown trout movement in a restored Appalachian watershed**

Ben Harris, J. Todd Petty

West Virginia University, School of Natural Resources, Morgantown, WV

Understanding the ecological response of organisms to global climate change and the efficacy of associated mitigation projects is of critical importance to those tasked with natural resource management. This study seeks to assess the response of native Brook trout *Salvelinus fontinalis* and exotic Brown trout *Salmo trutta* to restoration activities designed to increase thermal habitat suitability and improve access to historically severed tributaries within the Shavers Fork mainstem in eastern West Virginia. We implanted 51 Brook trout and 13 Brown trout with radio transmitters and tracked their movements over two field seasons (June-August 2015 & 2016). Average total movement observed among Brook trout was 3.09 km (0.12 km – 9.42 km), compared with 1.07 km (0.16 km – 3.18 km) for Brown trout. 31 Brook trout moved out of the mainstem channel into small tributaries (catchments <3 km²). In contrast, all tracked Brown trout remained in the mainstem channel and closely associated with restored habitat structures. These results confirm the importance of connected fluvial systems in facilitating Brook trout dispersal and maintaining large-scale metapopulation structure. Our study suggests that native fish communities may benefit more from the removal of dispersal barriers than structural habitat improvement on main-stem rivers.

$ Brook Trout Population Growth and Synchrony in the Central Appalachians

Ross G. Andrew and Kyle J. Hartman

Division of Forestry and Natural Resources, West Virginia University, Morgantown,

Identifying populations which act in synchrony across time and space may be valuable for understanding vulnerability and/or resilience to disturbance. We sought to identify variables which correlated highly with population growth rates and levels of synchrony for brook trout populations. We used a long-term brook trout dataset within 25 streams of West Virginia to analyze population growth rates across time and the correlation among demography of separate streams. We used regression to identify both local and regional variables related to population growth, and classification trees and random forest generation to identify variables which separated populations based upon their synchrony. Variables such as relative abundance of age-0 fish, mean fish length, and fall drought index were all important for defining population growth rate in a given stream or year. Variables such as age-2 fish abundance, spawning area, and distance to tributaries contributed greatly to partitioning of synchronous and asynchronous populations. These results help identify populations which are experiencing unique demographics and variables which may help explain reasons for these scenarios. Furthermore, this research provides some insight into resilience of brook trout populations within West Virginia as they respond differently to both local and regional factors.

Merging Ecology, History, and Law to Conserve Brook Trout in the Wild and Scenic Namekagon River, Wisconsin, USA

Patrick D. Shirey, Ecology Policy LLC, Sarver, PA 16055

The goal of this research is to determine the status of native brook trout (*Salvelinus fontinalis*) habitat in the wild and scenic Namekagon River of the St. Croix National Scenic Riverway, Wisconsin, USA. This research included three components to inform agency plans for protecting and restoring cold-water habitat in the face of changing climate. First, I assessed habitat change from pre-logging (before 1880) through the present day in the headwaters of the Namekagon River and its tributaries by reviewing historical records. Brook trout declined in abundance after logging, but this decline also coincided with the introduction of non-native brown trout (*Salmo trutta*) to the watershed. Second, we deployed temperature loggers to monitor summer temperatures (2012-2016), and surveyed fish communities and habitat features at 12 sites in 8 Namekagon River tributaries in 2012. Four of these cold-water streams held productive brook trout populations. Summer temperatures in the river were not optimal for brook trout, but also would not exclude their survival. Third, I place the results of our work within the context of regulatory and policy constraints placed on agencies in managing native brook trout in the presence of exotic brown trout. Management policies of both the National Park Service and Wisconsin Department of National Resources favor actions that promote native brook trout. Results will guide resource managers in (1) identifying and protecting habitat that is thermally suitable for brook trout and (2) implementing future restoration projects for habitat that is thermally suitable but not of sufficient quality to sustain brook trout populations.

The bogs of Loyalsock State Forest

$ **Katz, Harvey M.**

Along the Wisconsin Glacier's terminal moraine lies tens of thousands of bogs. About 100 of these are in the Loyalsock State Forest (LSF) between Ralston, on Route 14 and Hillsgrove, on Route 87 in Pennsylvania. This 35,000 acre (14,000 hectare) forest includes a variety of bog types. The area drains two watersheds, the Lycoming Creek watershed and the Loyalsock Creek watershed. Bogs are distinctive wetlands and have low pH and nutrients and are considered low productivity systems. This five year project, 2013-2017 has accumulated four years of data.

One of the striking characteristics is that bogs take many shapes. As a general rule the bogs follow the traditional early, mid and late successional character. The hydrology of the bogs is distinctive and many bogs have waterways flowing through them, regardless of successional stage. These bogs are described as "Fens." Other bogs have no waterway visible and several are stand-alone bogs with no apparent connection to a run or stream. Size ranges from 1/4 acre (0.1 hectare) or less to 80 acres (32 hectares). Of the 64 wetlands examined to date, eight have Pennsylvania threatened and endangered plant species, seven in the Lycoming watershed and one in the Loyalsock watershed. The remaining 56 bogs lack these plants. At least two bogs are seasonal in that they hold water only after snow melt or heavy rain, like vernal ponds they dry up during the summer season.

As a general rule the bogs tend to be remote and can be difficult to find. Only one bog is near a wood road. The remaining 63 sites are deep in the woods. Use of satellite imagery is necessary to locate these bogs. Basic data to describe the location, physical size, hydrology, dominant plant type, insect/arachnid, fish, amphibian, reptile, bird, and mammals are included in the bog description when found on the bog. Water quality is currently limited to pH, total dissolved solids and temperature. This presentation will describe the bog types, including some historical influence to explain bog varieties. These range from human activities such as splash dam construction, usually from the 1870 through 1930 lumbering period, to the natural activities of beavers. Both satellite and color photos will be used to give the audience a sense of what these bogs look like. The presentation will end with a brief effort to understand how the bogs fit into our current concept of ecological services.

Abstracts

Technical Session #3 – Breakout Session B

(Room B)

"Impaired Waters"

Thursday, February 9th

1:20 PM – 3:00 PM

Recovery of a Fish Assemblage Following a Unique Fish Kill in a Tributary of Monongahela River

David I. Wellman, Dan Cincotta, and Dustin Smith – West Virginia Division of Natural Resources – Wildlife Resources Section

The Dunkard Creek watershed encompasses nearly 180 square miles and meanders approximately 40 miles along the border of Monongalia County, West Virginia and Greene County, Pennsylvania and is a major tributary of Monongahela River. Fish surveys conducted by the West Virginia Division of Natural Resources – Wildlife Resources Section from 1959 through 2005 identified at least 44 fish species, with *Cyprinid* species having the greatest abundance. Thirteen species of sport fish, most notably Smallmouth Bass (*Micropterus dolomieu*) and Muskellunge (*Esox masquinongy*), were very popular among anglers, providing an important local fishery. Unfortunately, in September 2009 a fish kill essentially left the mainstem of Dunkard Creek devoid of fishes. Toxins released by Golden Algae (*Prymnesium parvum*) were determined to be the ultimate cause of death for an estimated 21,000 fish within 24 miles of Dunkard Creek in West Virginia alone. This was the first documented case of Golden Algae causing a fish kill this far north and inland from brackish waters, making it a very unique kill. The study objectives were to document recovery of the fish community and individual fish species following the 2009 fish kill. Parallel wire electrofishing was employed one month following the kill in 2009 and subsequently in years 2010, 2014, and 2016. Other researchers have observed fish communities to be resilient following similar disturbances and having relatively quick recoveries when little impact on surrounding watersheds and instream habitat occurred. Additionally, the closer proximity of potential colonizers typically increases a fish community's rate of recovery. Our Dunkard Creek study has made similar observations with the number of species and total abundance approaching pre-kill numbers within five years following the fish kill.

Dunkard Creek Pollution Event: Restoration Status of the Quality Sport Fish Populations

Rick Lorson and Mike Depew

Fisheries Management Area 8, Pennsylvania Fish and Boat Commission, Somerset, PA

Dunkard Creek is a 59 km coolwater stream tributary to the Monongahela River at Poland Mines, PA. The headwater portion upstream of Mount Morris, PA flows across the Pennsylvania/West Virginia border several times. A massive aquatic life kill over the 59 km occurred in September 2009 from toxins associated with golden algae (*Prymnesium parvum*) fueled by a high total dissolved solids mine discharge. The primary purpose of this study was to track the recovery of the sport fish populations from 2012 and 2016 sampling (post kill) at two fixed long term sites (35 and 47 km downstream of the pollution discharge point) compared to historic values and determine any fish management restoration efforts required. Smallmouth Bass (*Micropterus dolomieu*) mean total biomass post kill was above the long term mean at both sites. Smallmouth Bass catch per unit effort for quality length (over 300 mm) fish post kill was above the mean at 35 km and below the mean at 47 km. Sampling in 2012 recorded a high incidence of lesions (32%) in Smallmouth Bass at both sites. Rock Bass (*Ambloplites rupestris*) biomass post fish kill was below the long term mean at both sites. Channel Catfish (*Ictalurus punctatus*) over 400 mm and Walleye (*Sander vitreus*) abundance increased post fish kill. Saugers (*Sander canadensis*) were only present pre-fish kill. The Dunkard Creek fishery will continue to be managed with statewide regulations and a two year (2017, 2018) restoration stocking of Rock Bass. The fishery recovery status sampling will take place again in 2020, including assessment for a naturally reproducing Muskellunge (*Esox masquinongy*) population and fishery impacts from remaining discharges in the watershed.

Lower Dunkard Creek: An assessment of water quality and biology

Erika Bendick, Pennsylvania Department of Environmental Protection

One of the Pennsylvania Department of Environmental Protection's (Department) assessment methodologies is an Instream Comprehensive Evaluation survey which is used to assess surface waters of Pennsylvania. In the fall of 2014, Department staff completed a survey where data was collected at 36 stations in the lower portion of Dunkard Creek. Among the data collected were water chemistry grab samples, macroinvertebrate biological samples, and habitat assessments. This data and other department data were analyzed, and an index of biotic integrity (IBI) for benthic macroinvertebrates score was generated for each station sampled. The IBI scores were then used to help in determining the health of aquatic communities within the watershed. Of the 36 sites sampled, macroinvertebrate communities at 16 stations resulted in an IBI score <50 which signifies a heavily impacted watershed. Supplementing IBI scores with associated water chemistry and habitat assessments, the data can be used by department staff to report stream conditions and to determine proper pollution control programs and monitoring programs on the assessed portion of the stream.

$ **Beech Creek Invertebrates**

Whitney Peters and Steve Seiler – Lock Haven University

Beech Creek watershed is one of the many waterways in Pennsylvania that has been affected by coal mining. Acid mine drainage is evident in these streams, specifically in Beech Creek. The objective of this study is to analyze the quality of Beech Creek and four of its tributaries through invertebrate community sampling. Invertebrate samples were taken from Beech Creek and its tributaries for four months beginning in September. I identified each sample to family level and calculated common metrics of diversity and a biotic index to categorize sites into impact categories. My results help assess which tributaries require the most attention rehabilitating the watershed.

Recovery of a Reservoir Fish Community from Acidification

Dustin M. Smith[1], Stuart A. Welsh[2], Nate D. Taylor[3], and Corbin D. Hilling[4]

[1] West Virginia Division of Natural Resources, Farmington, WV [2] USGS West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown, WV [3]West Virginia Division of Natural Resources, Parkersburg, WV [4]Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA

Cheat Lake, a hydropower reservoir in northern West Virginia, has been impacted by acid mine drainage since the formation of the reservoir in 1926. As a result, several fish species were extirpated or nearly so from the reservoir, and fish species richness and abundance were limited. Surveys from 1952 - 1977 indicated few species present, with bullhead catfishes and White Suckers accounting for the large majority of fishes collected. Due to successful efforts to improve water quality within the watershed, the fish community of Cheat Lake has substantially changed over the last few decades. To assess these changes and to monitor for potential impacts from hydropower operations, biomonitoring has been conducted regularly on Cheat Lake since 1990 using boat electrofishing and gill netting surveys. Data from these surveys were analyzed to determine if significant changes have occurred to the Cheat Lake fish community over time. Since 1990, 18,002 fishes representing 44 species have been collected in Cheat Lake. Overall, electrofishing catch-per-unit-effort of fishes has increased from a low of 117 fish/hr. in 1990 to a high of 681 fish/hr. in 2015. Total gill net catch-per-unit-effort was as low as 3 fish per net-night in 1998 and as high as 12 fish per net-night in 2012. Statistical analyses of fish community data using non-metric multidimensional scaling and multivariate generalized linear models suggest that the fish community has significantly changed over time. These changes are primarily due to increases in abundance of several species that comprise the fish community, and decreases in pollution tolerant species such as Brown Bullhead. Results also suggest that the fish community of Cheat Lake exhibits significant spatial differences with differences in community structure across reservoir zones (i.e., riverine, transitional, lacustrine, and embayment zones). In particular, species such as Smallmouth Bass, Channel Catfish, Walleye, Golden Redhorse, Silver Shiner, and Emerald Shiner have seen substantial increases in abundance and distribution throughout the reservoir. Changes to the fish community are likely the result of water quality improvement efforts throughout the watershed. Continuation of these efforts is critical to the conservation of this valuable resource.

Student-Mentor Session

A student-mentor session will offer students, who may be seeking career opportunities within the environmental field, a unique chance to discover available options. The session will include two general parts. The first part will incorporate a panel discussion with representatives from various state/federal/professional entities, here students will have the opportunity to hear specific job duties from the representatives and have a question/answer session about job related concerns or interest, or just get specific information about the hiring process. The second portion will be much less formal, and will allow students to mingle and approach various mentors with more specific questions. This will allow students to investigate what career fields are most aligned with their personal interest, and may also provide mentors with a first impression of their future coworker.

Abstracts

Poster Session

Thursday, February 9th

6:00 PM – 9:00 PM

$ - Eligible for Best Student Poster

Argent,D.G., **J. Bartram**, and **N.Nelson**

Benthic fish and macroinvertebrate communities of the Monongahela River: A recovery in jeopardy

California University of Pennsylvania

Dramatic improvements in water quality of the Monongahela River resulting from the Federal Clean Water Act have spurred the recovery of its fish and macroinvertebrate communities. However, recent threats from invasive species and newly emerging energy extraction industries may jeopardize these gains. In order to determine the status of its benthic riverine biota in light of these recent stressors, we sampled fish and macroinvertebrates from 22 stations spaced approximately 1.6 km apart, in two contiguous Lock and Dam pools with a benthic trawl and a Ponar grab sampler, respectively. Concurrent with biological measurements, we used a Van Dorn bottle to obtain a benthic water sample at each site to measure specific conductance (µS/cm). Macroinvertebrate communities are dominated by the invasive zebra mussel (*Dreissena polymorpha*), and fish communities differ in relation to specific conductance. This data suggests the need for continued monitoring of the river's benthic fauna as part of the overall bioassessment of this major waterway in southwestern Pennsylvania.

$ **Barshinger, Cooper** and Dr. Moyer

The effects of stocked trout on *Exoglossum maxillingua* (Cutlip minnow) predator prey relationship within the Tioga River Watershed

Mansfield University of Pennsylvania

The objective of this study was to look at how native minnows are affected by stocked predators. Cutlip minnows were examined for differences in age and growth in stocked and non-stocked streams. Two stocked and non-stocked streams were randomly sampled using an electrofishing backpack. The minnow's lengths were assembled into a length histogram to observe the ages. The relative weight was then plotted for age one fish to examine growth. From the results an average age of the minnows was found to be less in non-stocked populations and the growth was found to be similar in both stocked and non-stocked.

$ **Bechdel, K**., G. Belson, and S.M. Seiler

Assessment of stream community and food web interactions in three streams feeding the Keller Reservoir

Lock Haven University of Pennsylvania, Lock Haven, PA

The purpose of this research project was to evaluate the health of three stream communities that feed the Keller reservoir in Clinton County, PA. (East Kammerdiner Run, McElhattan Creek, and Lucus Run). The Keller reservoir water shed is important because it is the public water supply for the city of Lock Haven and is managed for recreational activities and some timber activity. Fish were collected by electroshocking at all locations. Macroinvertebrates were collected with a D-frame net, with two composite samples being taken at McElhattan Creek and East Kammerdiner Run and one sample at Lucus Run. Simpson's diversity index and Hilsenhoff Biotic Index were used to evaluate the macroinvertebrate populations. Trout biomass was calculated from lengths taken in the field to evaluate fish populations. Elemental analysis was performed on sediment, macroinvertebrates, and fish tissue to observe any heavy metal accumulations in the food web. Macroinvertebrate data showed that the diversity was high throughout all streams. Fish biomass was healthy in all streams, with exceptional biomass in McElhattan Creek. Elemental analysis data showed that there was no heavy metal accumulation within any of the tested elements. We conclude that all streams were in good health and the water flowing into the reservoir is not adversely affected by any activities in the watershed.

$ **Belson, Greg** [1], Chris Rocco[1], Heather Bechtold[1], Steve Seiler[1], Chuck Keeports[2] and Nathan Welker[2]

Use of invertebrate samples as indicators of stream community health in the Allegheny National Forest

[1]Lock Haven University, Lock Haven, PA [2]US Forest Service, Allegheny National Forest, Warren, PA

The purpose of this project was to provide current data on fish and macroinvertebrate communities in wadeable streams across the central portion of the Allegheny National Forest. In the summers of 2015 and 2016, 44 Streams were sampled for macroinvertebrate and fish communities. Surber samples were taken back to Lock Haven University to be identified for Simpson's Index and Biotic Index calculations. Fish surveyed for the project were identified and measured before being released. Analysis of invertebrate and fish communities showed that the streams were of good to moderately good quality. The data on the health of the stream communities will be helpful in making informed management decisions for the forest.

$ **Fetterman, Jacob A.,** Dr. Steven Seiler, and Dr. Heather Bechtold

Analyzing the impacts of pipeline corridors on headwater stream productivity in central Pennsylvania

The need for alternative energy sources has driven hydraulic fracking into Pennsylvania and the Marcellus Shale region over the past few decades. This boom has led to the construction of 7,788 currently active sites, 832 of those in Lycoming County. Our objective therefore was to assess stream productivity where pipeline corridors intersect headwater streams to determine the type of management strategies that should be formed and implemented to negate any negative effects of the corridors. In order to assess stream productivity, we measured chlorophyll a content at 3 sites, comparing the upstream and downstream measurements to those taken in the corridor. We also examined macroinvertebrate richness, dominance, and diversity. We found a clear distinction between chlorophyll a content in the corridors (27.00 mg/m^2) and upstream/downstream of the corridor (19.66 mg/m^2). Family richness and diversity each decreased in the corridor at two of the three sample locations. These results imply that management strategies should be implemented that mitigate the negative impacts associated with increasing allochthonous productivity where the ecosystem is dependent upon and has adapted to mainly autochthonous productivity.

$ **Glossner, Kayla** and Steven Seiler

Effects of animal agriculture on the Marsh Creek watershed

Lock Haven University of Pennsylvania

The Marsh Creek Watershed is currently listed on the Environmental Protection Agency's list of impaired streams, mainly due to animal agriculture via runoff. This study assessed water quality at eight different locations in the watershed via testing for nitrate, nitrite, and phosphate concentrations. Invertebrate samples were also collected from each site and were assessed by the Hilsenhoff biotic index. These results were put into a GIS layer and overlaid on a land-use map that was downloaded from PASDA. The results of this study will tell us which sections of the watershed are experiencing decreased water quality throughout seasonal changes in weather patterns. With this knowledge one could inform local farmers of practices that can decrease nutrient runoff.

$ **Gurbatow, Jeremy**, Daniel Isenberg, Michael Bilger, and Dr. Jonathan Niles

Biological Effectiveness of Instream Restoration

Susquehanna University

Agriculture impacts stream ecosystems through a variety of means including increases in sedimentation, increased runoff of pesticides and nutrients all of which can create changes in stream habitats, as well as shifts in fish and benthic macroinvertebrate assemblages. In recent years, however, many farmers have become open to changing farming practices. In conjunction with the Montour, Northumberland, Snyder and Union County Conservation districts, seven local farmers agreed to have riparian habitat restoration projects constructed on streams that run through their property. In order to test the biotic response to the restoration process, we conducted pre-restoration sampling in summer 2015, and post restoration sampling in summer 2016, with another post restoration sample to be conducted in summer 2017. Stream assessments consisted of benthic macroinvertebrate sampling according to Pennsylvania Department of Environmental Protection protocol, backpack electrofishing of a 100m site, and collection of standard water chemistry data. After the restoration process was complete, a one-year post restoration sampling was conducted yielding positive increases in overall fish populations at sample sites. Overall fish populations increase at Little Shamokin Creek (163.6%), Turtle Creek (50.9%), Limestone Run A (190.3%), Limestone Run B (69.6%), and Limestone Run C (134.05%). With an increase in riparian buffers and increased retention of stream bank sediment, the streams are seeing a positive increase in stream biota due to likely decreases in sedimentation, and increases in habitat.

$ **Hake,Sean**, Dr. Dan Ressler, Dr. Jonathan Niles

Prioritizing Brook Trout sampling in unnamed tributaries using a network model

Susquehanna University, Freshwater Research Initiative

Pennsylvania has 62,750 streams and only 8000 of those have been sampled for fish populations. Our main objective is to prioritize which streams should be sampled to find populations of Brook Trout. A network model approach is used to map Brook Trout habitat that allows for a visualization of connectivity between suitable habitats. A network model is a tool that can calculate pathways or routes based on minimizing costs associated with each network path. The network model has three major components; restrictions, starting points and costs. We are attempting to model brook trout habitat and potential movement of fish within a stream network using network model. We start with the known population from a field survey and assign travel costs within each stream network segment based on the probability of brook trout populations in that segment. We have developed additional cost equations that add greater cost as a function of the number of coal mine sites on the PA DEP mine inventory database, and the number of oil and gas wells on the PA DEP oil and gas well database. We added physical barriers to the network model where we calculate a stream and road intersection as a culvert. It was found in the study that the network model seems to be an effective visualization tool for estimating brook trout habitat and potentially linked populations. This study illustrates suitable Brook Trout habitat while visualizing the connectivity of pathways for fish travel in unnamed tributaries.

$ **Heisler, Ryan E**. [1], Logan R. Stenger[1], Katie Mattas[1], Ryan Braham[2], Dennis Johnson[1] and George T. Merovich, Jr.[1]

Linking patterns in endocrine-disrupting compounds to storm discharge and YOY SMB health in the upper Juniata River watershed

[1]Department of Environmental Science & Studies, Juniata College, Huntingdon PA [2]US Geological Survey, Fish Health Branch, Leetown Science Center, Kearneysville, WV

Population declines and disease incidence in smallmouth bass (*Micropterus dolomieu*) in the Susquehanna River basin have been linked to endocrine-disrupting compounds (EDCs) as a likely causative agent. Nothing is known about this link in the upper Juniata River basin and how EDC patterns may vary with hydrologic conditions. Consequently, we sampled water in the basin for EDCs across a range of discharges to identify possible connections between storm flow and spikes in EDC concentrations. We surveyed young-of-the-year (YOY) smallmouth bass populations, collected information on their diet, and recorded incidence of disease as well. We found high variation in EDCs concentrations (measured as total estrogenicity) at the site level and across the watershed. EDC concentrations varied with discharge. YOY smallmouth bass were in excellent condition and sustained very few abnormalities. Nearly all individuals had abundant prey items in the stomach. Much of this study is still on-going, including histopathological analysis of fish, but early indications suggest that EDCs are present in quantities that should be considered important for addressing smallmouth bass anomalies in the broader Susquehanna River basin.

$ **Hess, A**., D.G. Argent, and W.G. Kimmel

Status of fish and macroinvertebrate communities above and below three steam impoundments: thermal implications

California University of Pennsylvania

Many flowing waters of various sizes In Pennsylvania are impounded along their watercourses for historical and current anthropogenic development. The creation of such pools provides increasing surface area for solar heating disrupting seasonal temperature rhythms below these blockages. Here, we compare the annual temperature cycle above and below three impounded streams on the Laurel Hill and their attendant macroinvertebrate communities. We placed temperature data loggers in the riparian zone and in-stream, above and below the SF of Sugar Creek Dam, Kooser Dam, and the NF of Bens Creek Dam. We sampled macroinvertebrates at each location during late spring of 2016. Thermal profiles suggest some dynamic patterns in relation to surface area and conservation release strategy on the respective downstream reach. Total taxonomic richness, composition, and abundance of macroinvertebrate communities above each impounded reach differed from downstream locales. This study highlights the need to investigate the role that such impoundments play in the face of global climate change on macroinvertebrate community composition and density.

Kinder, Paul[1], Steve Brown[2], **David Thorne**[2], Edward Watson[3], TJ Burr[4], Todd Petty[5], and Eric Merriam[6]

West Virginia wild trout stream restoration

[1] West Virginia University Natural Resources Analysis Center [2] West Virginia Division of Natural Resources [3]Canaan Valley Institute [4] Natural Resources Conservation Service [5] Davis College of Agriculture, Natural Resources, and Design, West Virginia University [6] West Virginia University Research Corporation

A look at recently completed stream restoration and trout habitat improvement projects completed through multiple-partner collaboration in West Virginia. State and federal agencies, non-governmental organizations, academic researchers, and private companies were involved on recent major stream restoration projects that would not have been possible without all the collaboration. Large-scale stream restoration and habitat enhancement projects are never easy, but the can become more successful through multi-disciplinary partnerships.

$ **Massie, Danielle L**.[1], Michael Moran[1], Geoff D. Smith[2], and Tyler X. Wagner[3]

Comparison of population characteristics of Flathead Catfish across a range of establishment levels at the Susquehanna River

[1]Pennsylvania Cooperative Fish and Wildlife Research Unit, The Pennsylvania State University, University Park, PA [2]Division of Fisheries Management, Pennsylvania Fish and Boat Commission, Harrisburg, PA [3]USGS Pennsylvania Cooperative Fish and Wildlife Research Unit, The Pennsylvania State University, University Park, PA

Flathead Catfish (*Pylodictis olivaris*) are apex predators, capable of sustaining success with limited resources. Because of their hardy nature, they have become an invasive species in many river systems, and their negative impact on native fishes is well documented. Flathead Catfish were first discovered within the Susquehanna River, PA in 2002, just below the Safe Harbor Dam. Since their initial sighting, there have been no comprehensive surveys to document their population characteristics or current range. This study aims to evaluate the population characteristics of Flathead Catfish within a 173 km stretch of the Susquehanna River's main-stem. We sampled three randomly selected segments from each of the three reaches (with varying degrees of presumed establishment) during July -September 2016. Flatheads Catfish (N= 129) were collected using four series of baited, tandem hoop nets. Nets were fished at depths greater than 1 m, and left undisturbed for approximately 72 hours. We will be using ages determined from otoliths and length data (mm) to estimate flathead growth rates among reaches. Through the use of a hierarchical Bayesian von Bertalanffy model, we will be able to compare growth rates across spatial gradients. Our hope is that information gained from this study will help fisheries managers more adequately make decisions regarding the introduced Flathead Catfish populations at northern latitudes.

$ **Murray, Jessica**

Analyzing brown trout movement data using ArcGIS

Juniata College

Brown trout (*Salmo trutta*) are an important game species in Pennsylvania, and understanding their behavior is important to fish management. The objective of this study is to calculate movement data collected from brown trout in the Little Juniata River, a tributary of the Juniata River in the Susquehanna watershed. Researchers tracked 24 brown trout fitted with radio transmitters (Lotek MST930MT) from March through November 2015. Using ESRI ArcGIS software, each known location of individual fish was plotted and intersected with a polyline shapefile of the river. A starting point or zero location was assigned near the headwaters of the river. The distance from the starting point was calculated for each known trout location. These distances were then used to calculate the river range of each fish. This technique is useful to measure actual distance covered by fish in meandering river systems. Movement of 2 km and greater were typically associated with storm events, turbidity and low flow conditions. We found that fish activity increased from April to October, and the average distance travelled increased each month. A sharp increase in movement was seen during the month of October (16415 meters), more than doubling the average movement of April (7641 meters). This could indicate the start of the spawn. Several water quality parameters such as temperature, conductivity and turbidity also changed during that time period, typical for the transition from spring to autumn. We plan to use this technique to calculate distance covered by fish tracked from early fall to spring.

Ressler, Dan, Tia Kissinger, and Jon Niles

Prioritizing unnamed tributary sampling for Brook Trout using landscape variables

Susquehanna University, Freshwater Research Initiative

Brook trout in Pennsylvania streams are an important species not only because they are a sought after recreational species but also because their presence promotes that stream segment to the most stringent water quality protections in PA Code Chapter 93 regulations. To locate these species on the nearly 50,000 un-sampled tributaries in PA requires a prioritization scheme to identify the most likely suitable habitats from GIS data sources like soil or geology, land use, and terrain, before dispatching biological sampling crews. We applied multivariate and logistic statistics to a dataset of landuse, soils, and terrain variables that we assembled using watershed basin boundaries that were drawn on primarily first order stream segments on the NHD 1:24000 DEM. Using 55 un-named tributaries in White Deer Creek and Buffalo Creek watersheds in Central PA, we were able to successfully predict the presence of brook trout in 76% of our validation stream segments. This study illustrates that habitat similarity can be identified with basic statistical methods and used to identify other suitable habitats that should receive priority sampling in order to better protect these stream segments against development and other encroachments.

$ **Thompson, Tyler J**. [1], Tyler Wagner[2], Vicki Blazer[3], Megan Kepler[1], Jonathan Niles[4], and Adam Sperry[5]

An investigation into the role of groundwater as a point source of emerging contaminants to Smallmouth Bass in the Susquehanna River

[1]Department of Ecosystem Science and Management, Pennsylvania State University, University Park, PA, [2]USGS Pennsylvania Cooperative Fish & Wildlife Research Unit, Pennsylvania State University, University Park, PA [3]Leetown Science Center, USGS, Kearneysville, WV, [4]Department of Biology, Susquehanna University, Selinsgrove, PA, [5]National Fish Health Research Laboratory, USGS, Kearneysville, WV

Since 2005, high young-of-year natural mortality rates and declines in adult indices of abundance have been observed in some smallmouth bass populations in the Chesapeake Bay Watershed, and specifically in the Susquehanna River Basin. Endocrine disrupting compounds (EDCs) are hypothesized to be a contributing factor to the observed population dynamics. In order to better understand these compounds in the environment and their effects of fish populations, further research is needed into exposure pathways. In particular, there is a paucity of information on the role of groundwater as a source of EDCs for aquatic organisms. In fact, current research at river sites throughout the Chesapeake Bay Watershed, including in Pennsylvania – where surface water, stream sediment, and adult/young-of-year smallmouth bass are sampled for contaminants - led to the hypothesis that groundwater could be a potential exposure pathway for EDCs. Therefore, the objective of this research was to investigate the role of groundwater as a point source of emerging contaminants to smallmouth bass in the Susquehanna River Basin. Using thermal cameras to locate areas of groundwater upwelling, we sampled groundwater using drive-point piezometers from two sites in Pennsylvania. Samples were taken weekly starting before the smallmouth bass spawning season and continued for 15 weeks throughout the summer. As an initial water chemistry analysis, total estrogenicity was quantified through a bioluminescent yeast estrogen screen to use as an indicator of the presence of estrogenic EDCs. Surface water total estrogenicity samples were also taken at these sites to compare with the groundwater samples. Preliminary analyses suggest that groundwater samples may be an important pathway of exposure, especially given the use of these areas for spawning by smallmouth bass.

$ **Zinn, David**, Jon Niles, and Mike Bilger

Invasion of the Middle Creek watershed by the Rusty Crayfish (Orconectes rusticus)

Susquehanna University

Understanding how the introduction of invasive species affects not only native populations, but also the local ecosystem, is essential for determining the total impact of these species. In addition, examining how physical barriers like dams or hanging culverts and environmental barriers such as water flow affect invasive species is beneficial when deciding how to allocate resources to protect native populations. Our study conducted in the fall of 2016 seeks to determine the effects of two Central Pennsylvania reservoirs (Walker and Faylor Lakes) on the invasion of the rusty crayfish (Orconectes rusticus) and the effects of drought on the crayfish populations of Middle Creek (Snyder County, Pennsylvania). A one-meter square frame net was used to sample ten stream sites above and below Walker and Faylor Lakes over several weeks. To sample the lakes themselves, modified minnow traps were used to sample six sites, three in each of the two reservoirs. All individuals were measured in order to determine size class. Representatives of each size class from each area were dissected in order to determine diets. Initial results indicate only individuals of the native Appalachian brook crayfish (Cambarus bartonii bartonii) in the sites above Walker Lake, indicating this reservoir could be a barrier to invasion. Based on previous results of rusty crayfish diets, we expect to see younger age classes of crayfish eating primarily benthic macroinvertebrates while older age classes will likely consume primarily a plant and organic matter based diet. Understanding the impacts of aquatic invasive species such as Orconectes rusticus can help us better understand how these species disrupt ecosystems and alter food webs.

Beth Dakin and Brady Porter

Water quality monitoring in the lower Allegheny River and its tributaries

Center for Environmental Research and Education, Duquesne University, Pittsburgh, PA

Since January 2013, we have monitored multiple parameters of water quality at 14 sites in the lower Allegheny River drainage (from Pittsburgh upstream to Parker, PA, just downstream of the Clarion River). This sampling is a part of the 3 Rivers QUEST (Quality Useful Environmental Study Teams), a comprehensive water quality monitoring and reporting program, which gathers data on the Monongahela, Allegheny, and upper Ohio River systems. Sampling took place biweekly from January 2013 to July 2015, and has continued on a monthly basis to the present. Some of the parameters measured have established levels for drinking water standards, while other chemical parameters or ratios between parameters can serve as indicators for specific types of pollution, such as abandoned mine drainage (AMD), road salt runoff, and produced water from hydraulic fracturing for natural gas extraction.

Since we now have accumulated four full years of biweekly/monthly data for these sites, we have begun to analyze both trends over time within sites as well as comparing concentrations and ratios of various parameters between sites within the lower Allegheny River drainage. Blacklick Creek, a tributary of the Conemaugh River, is known to have been impacted by both AMD and Marcellus Shale treated water and shows distinctly different pH, Ca:Mg vs. Ca:Sr, and Cl vs. Br:Cl when compared to other sites in the region. Other anomalous values are seen at Pine Creek (Allegheny Co., sampled in Etna, PA) and Deer Creek (Allegheny Co., sampled in Harmar, PA).

Workshop Descriptions

Conservation, Ecology and Identification of Mid-Atlantic Crayfishes

Instructor: Zachary Loughman, Ph.D., West Liberty University (zloughman@westliberty.edu)

There are more than 350 species of crayfish in North America with around ½ currently threatened with population decline or extinction. This workshop will review crayfish biology, distribution, and ecology specific to the Mid-Atlantic region. Focus will be placed on the major anatomical characteristics used to differentiate crayfish species and key concepts associated with their taxonomy. Special attention will be made to learn how to differentiate between non-native and native species and discuss the history and potential future for crayfishes in the Mid-Atlantic region. Identification keys will be provided and attendees will have the opportunity to key out live and preserved specimens of regional crayfish species. **Participants will need to bring a magnifying glass to participate in the identification portion of the workshop.**

Fish Health Investigations: An introduction to Field Methodologies and Emerging Techniques

Instructor: Vicki Blazer, Ph.D., United States Geological Survey (vblazer@usgs.gov)

The Fish Health workshop at the PA/WV American Fisheries Society meeting will provide a general overview of what is involved in a fish health investigation with relevant case studies from both Pennsylvania and West Virginia. We will cover the use of visible lesions, organosomatic indices, histopathology, plasma analyses and identification/culture of pathogens. The methods, advantages, disadvantages, uses and misuses of each will be discussed. Participants will be also be introduced to emerging and cutting edge techniques that are being incorporated into current fish health investigations including immune function, gene expression and molecular identification of pathogens. Discussion and topics will also cover broad considerations for fish health including sampling design and other ecological factors effecting the study organisms that need to be considered.

Introduction to R and techniques for analysis of ecological communities

Instructor: George T. Merovich, Jr., PhD, Juniata College (merovich@juniata.edu)

R is an open-source programming language and environment for statistical computing. It is freely available for download from http://www.r-project.org. R is very popular in the ecological fields because of its power and flexibility for data analysis, modeling, and graphics. R uses an object-oriented environment from a command line interface. Built-in functions for statistical analysis are supported by documentation and help features. Numerous customized packages submitted by statistical gurus make R extremely extendable to specialized tasks. In this workshop we will introduce the beginner to R and the wealth of help-resources available for R users. After becoming oriented to the R environment, we will demonstrate analyses for summarizing information contained in ecological dataset (i.e., site by species and environmental datasets). The workshop is targeted to anyone with little experience in R, but needing to analyze ecological datasets efficiently. **Attendees should bring a laptop with R installed and capable of downloading and installing customized packages, like vegan. Practice datasets will be available, but participants could bring their own.**

For graciously hosting the joint meeting, the PA and WV Chapters would like to thank the

California University Student Sub-unit of the Pennsylvania Chapter of the American Fisheries Society

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*The PA/WV Executive Committee's would like to say **THANK YOU** for your attendance at the Annual Technical Meeting and for your support throughout the year. We look forward to seeing everyone again next year.*