WATER TENSION AND THE GREAT LAKES COMPACT

Annin, Peter

Ballroom ABC
Monday, 18 May, 2015 09:15 - 10:00

This presentation delves into the long history of political maneuvers and water diversion schemes that have proposed sending Great Lakes water everywhere from Akron to Arizona. Through the prism of the past, this talk analyzes the future of Great Lakes water diversion management, which is now controlled by the Great Lakes Compact, a legal document released by the Council of Great Lakes Governors in December 2005. The Compact, which prohibits most Great Lakes water diversions, with limited exceptions, was adopted by the eight state legislatures in the Great Lakes region as well as the U.S. Congress before eventually being signed by the president in 2008. A similar agreement relating to Canadian water diversions was adopted by the province of Ontario in 2007 and Quebec in 2009. This presentation analyzes several noteworthy Great Lakes diversions that already exist, and sheds light on potential water diversions of the future, including the water diversion application submitted by Waukesha, Wisconsin in 2010. A decision on the Waukesha water diversion application is expected in late 2015 or early 2016.

ALIEN ECOGEOMORPHOLOGY: IMPACTS OF AN INVADING ECOSYSTEM ENGINEER ON RIVER SEDIMENT DYNAMICS AND TROPHIC INTERACTIONS

Rice, Stephen; Mathers, Kate; Johnson, Matthew; Wood, Paul; Reeds, Jake; Longstaff, Holly; Extence, Chris

101CD
Monday, 18 May, 2015 10:30 - 10:45

Animals that dig burrows in river banks and beds are uncommon in the UK. The invasion of signal crayfish (Pacifastacus leniusculus), a prolific ecosystem engineer, has changed that, with implications for geomorphology, sediment dynamics and benthic ecology that benefit the invader. Burrowing directly introduces sediment to rivers and accelerates bank collapse, making substrates finer and increasing the quantity of sediment available for transport. In addition, energy expenditure by signals can mobilise sediment under incompetent hydraulic conditions. Field measurements in central England reveal suspended sediment fluxes that are partly driven by diel and seasonal variations in crayfish activity, with up to 50% of cumulative sediment load attributable to signals during summer low flows. These geomorphological impacts amplify the direct, ecological impacts of crayfish on benthic communities. For example, ex-situ experiments show that by limiting access to hyporheic refugia sedimentation constrains the avoidance (burrowing) behaviour of Gammarus pulex, increasing predation by signals. Alongside other ecogeomorphological interactions, crayfish-induced sedimentation may, therefore, extend the widely noted predatory effect of P. leniusculus on sessile taxa by rendering labile, burrowing macroinvertebrates relatively more vulnerable to predation.

FURTHER DOWN THE RIVER : A NOVEL, SPECTROPHOTOMETRIC, IN-SITU TECHNOLOGY IMPROVING SPATIAL AND TEMPORAL DATA RESOLUTION TO ADDRESS HETEROGENEITY IN AQAUTIC SYSTEMS.

Maxwell, Bryan

103C
Monday, 18 May, 2015 10:30 - 10:45

Evaluating ecosystems requires understanding of the heterogeneity of such systems. Aquatic systems exhibit variability over space and time; seasonal and daily fluxes induce transient biogeochemical conditions, and spatial differences give rise to hot spots of activity. Biological activity of riverine and lacustrine environments can be assessed by observing nutrient uptake and transformation. Recent advances in field spectrophotometers were combined with inexpensive technology to produce an automated, programmable system capable of high frequency data at the space/time scale. The system utilizes multiple intake ports and is designed for use in field mesocosm studies to provide increased number of replicates and high confidence of results. Preliminary data shows high reliability in measuring nitrate, TN, COD, DOC, sulfate, and several metals. Tracking of additional parameters can be performed using simple PLSR methods. Present research with the developed system includes quantifying nitrogen uptake rates in a pre-restoration stream using in-situ, mesocosm drums. Findings include high data resolution showing seasonal change and spatial variability along the reach in N-uptake rates.

FRESHWATER FUTURES: ECOSYSTEM SERVICES, MULTIDISCIPLINARY APPROACHES, AND HOW FUTURE STREAM ECOLOGISTS CAN HELP SAVE THE WORLD

Dodds, Walter

101A
Monday, 18 May, 2015 10:30 - 10:45

Freshwater is an essential resource for humanity and provides key habitat for much threatened biodiversity. The services that freshwater ecosystems provide humans are very diverse ranging from water quantity and quality, to biodiversity and cultural and recreational values. People also influence freshwater systems in a wide variety of ways. Stream ecologists in particular have a holistic view based on the reality of streams being driven by their watersheds. This view demands a multidisciplinary approach if we are to conserve and protect freshwaters. In the anthropocene we are under unique conditions driven by global change. In this context, societal factors interface with physical, chemical, geomorphologic, hydrologic, organismic, population, community, ecosystem, landscape and macroscale features of freshwaters. We have unprecedented tools to study freshwaters (advance analytical, molecular, big data approaches) at just the time when decisive action by humanity is required to preserve these systems. Future stream ecologists can thus make the world a better place by helping us toward a predictive understanding of streams and rivers, and the lakes, wetlands, groundwater and marine habitats they link to.

FRESHWATER MUSSELS INCREASE SEDIMENT DENITRIFICATION IN AN URBAN RIVER

Hoellein, Timothy; Zarnoch, Chester; Bruesewitz, Denise

102C
Monday, 18 May, 2015 10:30 - 10:45

Freshwater mussel (Unionidae) beds are biogeochemical ‘hotspots’ in lotic ecosystems. Other bivalves with dense colonies (e.g., zebra mussels, Asian clam, oysters) enhance conditions required for denitrification, or the anaerobic reduction of nitrate to nitrogen gas, a loss of nitrogen (N) from the aquatic environment. Unionid’s role in denitrification is unknown. In summer 2014, we measured density, assimilation, and sediment N cycling effects of Lasmigona complanata (white heelsplitter) and Pyganodon gradis (giant floater) in the DuPage River’s East Branch near Chicago, Illinois, USA. We completed streamside measurements of feeding and biodeposition, and flow-through mesocosms with 15N tracers (as ammonium and nitrate separately) with live mussels in the laboratory. Both taxa significantly increased nitrate uptake and denitrification relative to sediment alone. Feeding rates were similar between mussel species, however, N biodeposition was greater in L. complanata. We calculated the economic value of mussel-mediated denitrification as an ecosystem service using well-established methods for oysters. Overall, freshwater mussels enhanced denitrification despite eutrophic conditions, and their contribution to N removal as an ecosystem service may represent an underutilized conservation tool for this widely imperiled taxon.

IMPROVED METHODS FOR WEIGHTING SPECIES DISTRIBUTION MODELS TO IMPROVE ENSEMBLE MODEL PREDICTIONS

Wenger, Seth; Som, Nicholas

101B
Monday, 18 May, 2015 10:30 - 10:45

It has become increasingly common to make species distribution predictions and forecasts from ensembles of multiple models. Methods for weighting competing models have lagged, however, and the prevailing approaches are either to weight models equally or to use simple decay functions. We present a general approach to model weighting that more accurately preserves the relative differences in performance of alternative models. It involves (1) creating numerous bootstrapped datasets from the original dataset; (2) running each model on each dataset; and (3) recording the proportion of times each model is selected as "best" for a dataset using a given performance criterion. This proportion is the model weight. We illustrate the approach with a set of species distribution models built from large trout dataset. The R functions to implement the method are freely available and will soon be adapted into a formal package.

SPATIAL SCALE VARIATION IN TOP-DOWN EFFECTS

Garcia, Erica; Lacksen, Katherine; McMaster, Damien ; King, Alison; Douglas, Michael

102DE
Monday, 18 May, 2015 10:30 - 10:45

Most experiments examining top-down (consumer) control in stream ecosystems have focussed on only a single spatial scale, frequently < 1 m². The strength of top-down control is known to be context dependent and may vary with spatial scale. We conducted a 40 day consumer manipulation experiment (i.e. fish and shrimp removal) at the patch scale (1 m² exclusion cages) and at the reach scale (whole-reach exclusions ~20 m length), with the aim of examining top-down effects at multiple scales within three streams in the wet/dry tropics of northern Australia. At the reach scale strong top-down effects on benthic algal biomass and macroinvertebrate density were observed, with evidence of a trophic cascade. However, at the patch scale there was no evidence of top-down effects. Our findings suggest that whilst most top-down experiments are conducted at small spatial scales they may yield misleading results if interpolated to larger scales.

REGULATION AND RESULTS: BIOTIC AND ABIOTIC CHANGES TO NORTHEASTERN LAKES FOLLOWING TIGHTENING OF AIR EMISSIONS RULES

McDowell, William G.; Webster, Katherine; Nelson, Sarah; McDowell, William H.; Haney, James

102B
Monday, 18 May, 2015 10:30 - 10:45

The Clean Air Act Amendments of 1990 reduced emissions of sulfur and other pollutants, and reduced acidic precipitation. USEPA’s ELS-II survey of 158 northeastern lakes in 1986 took water quality measurements and zooplankton samples, and found that many lakes were stressed by high acidity. In 2004, these lakes were re-surveyed to determine the effects of reduced precipitation acidity. We compared water quality metrics between 1986 and 2004 using paired t-tests. Using a linear mixed effects model, we examined changes in zooplankton lengths between sampling dates, using lake as a random variable and controlling for shifts in zooplankton taxa. Both sulfate and nitrate concentrations were significantly lower in 2004 (-20.97 and -0.520 ?eq/L, respectively), with larger declines observed for sulfate. Zooplankton were significantly longer in 2004, and this difference was significantly correlated with higher acid neutralizing capacity ($p<0.0001$) and lower sulfate concentrations ($p<0.0001$). These results indicate that lakes are experiencing both biotic and abiotic changes in response to tighter emissions controls. Future work will examine how zooplankton communities have shifted at the species level in response to changing deposition.

NEON: A NEW PLATFORM FOR LARGE RIVER ECOLOGY

Vance, Jesse; Fitzgerald, Michael; Parker, Stephanie; Roehm, Charlotte; Goodman, Keli; Bohall, Charles; Utz, Ryan

103DE
Monday, 18 May, 2015 10:30 - 10:45

The National Ecological Observatory Network (NEON) is a continental-scale infrastructure project designed to provide open source data to address the impacts of climate change, land-use, and invasive species on ecosystem structure and function. Using a combination of standardized continuous in situ measurements and observational sampling, the NEON Aquatic array will produce over 200 data products at each site for 30 years to facilitate spatiotemporal analysis of the drivers of ecosystem change. Three sites in Alabama were chosen to address linkages between watershed-scale processes and ecosystem changes along an eco-hydrological gradient within the Tombigbee River Basin. Two sites in the Black Warrior and Tombigbee rivers will provide a unique platform for large river ecological research. The NEON Aquatic design includes continuous measurements in surface water, groundwater, and meteorology. Observational sampling includes water chemistry, isotopes and a suite of biological indices from microbes to vertebrates. In 2013-2014 NEON conducted site characterization work to determine 1) the spatiotemporal variability across the water column, 2) spatial variability of surface water, and 3) the physical and biogeochemical drivers, informing our infrastructure designs and sampling protocols.

THE NEON AQUATIC NETWORK: STANDARDIZING DEPLOYMENT OF AQUATIC INSTRUMENT SYSTEMS ACROSS CONTINENTAL ECOSYSTEMS

Bohall, Charles; Fitzgerald, Michael; Vance, Jesse; Roehm, Charlotte; Goodman, Keli; Parker, Stephanie; McLaughlin, Brandon; Stewart, Jenna

103AB
Monday, 18 May, 2015 10:30 - 10:45

The National Ecological Observatory Network (NEON) is a national-scale research platform for assessing the impacts of climate change, land-use change, and invasive species on ecosystem structure and function. NEON will collect data for 30 years to facilitate spatial-temporal analysis of environmental responses and rivers of ecosystem change, ranging from local through continental scales. Using standardized methods and designs, the data collected can be compared across a wide variety of ecosystems at multiple scales. Standardized quality assurance and quality control allow data to be processed efficiently and disseminated to users through an online data portal. This presentation will present the design and deployment of the aquatic instrumentation systems within the NEON network. The network is comprised of 36 1st/2nd order wadeable streams, large rivers, and lakes. When coupled with aquatic observational data, the aquatic network will produce 200+ low-level data products for each site, available to users.

DISTRIBUTION PREDICTIONS IN THE GERMAN LTER-SITE RHINE-MAIN-OBSERVATORY: LONG-TERM MONITORING DATA MEET HIGH-RESOLUTION, CATCHMENT-BASED SDMS

Kuemmerlen, Mathias; Stoll, Stefan; Sundermann, Andrea; Haase, Peter

101B
Monday, 18 May, 2015 10:45 - 11:00

A long term monitoring dataset from the German long-term ecological research (LTER) site Rhine-Main-Observatory (RMO) was used to set up a species distribution model (SDM) in the Kinzig catchment. 175 taxa of stream macroinvertebrates were modeled and projected on the stream network at high resolution using bioclimatic, topographical, hydrological, land use and geological predictors. On average model performance was good, with a TSS of 0.83 (±0.09 SD) and. a ROC of 0.95 (± 0.03). The extensive knowledge on the monitoring data provided by the LTER-site framework delivers valuable insights on three possible sources of bias affecting SDMs in general: (a) the level of taxonomic identification of the modeled organisms, (b) the spatial arrangement of sampling sites, and (c) the sampling intensity at each sampling site. Results based on distribution predictions indicate that, for the RMO-LTER, occurrence data shows both spatial and temporal bias, while taxonomic identification does not affect model performance.

COLONISATION RATE AND ADAPTIVE FORAGING CONTROL THE EMERGENCE OF TROPHIC CASCADES

Fahimipour, Ashkaan; Anderson, Kurt

102DE
Monday, 18 May, 2015 10:45 - 11:00

Ecological communities are assembled and sustained by colonization. At the same time, predators make foraging decisions based on the local availability of potential resources, which reflects colonization. We combined field and laboratory experiments with mathematical models to demonstrate that a feedback between these two processes determines emergent patterns in community structure. Namely, our results show that prey colonization rate determines the strength of trophic cascades – a feature of virtually all ecosystems – by prompting behavioral shifts in adaptively-foraging omnivorous fish predators. Communities experiencing higher colonization rates were characterized by higher invertebrate prey biomass and richness. Consequently, fish functioned as predators when colonization rate was high, but as herbivores when colonization rate was low. Human land use is changing habitat connectivity worldwide. A deeper quantitative understanding of how spatial processes modify individual behavior, and how this scales to the community level, will be required to predict ecosystem responses to these changes.

RESPONSE OF FISH ASSEMBLAGES TO CHANGING ACID-BASE CHEMISTRY IN ADIRONDACK LONG TERM MONITORING LAKES, 1984-2012.

Baldigo, Barry; Roy, Karen

102B
Monday, 18 May, 2015 10:45 - 11:00

Fish assemblages and water chemistry in 52 Adirondack Mountain lakes were sampled by the Adirondack Lakes Survey Corporation and the New York State Department of Environmental Conservation (NYSDEC) during three periods (1984-87, 1994-2005, and 2008-12) to document regional effects of acidic deposition and to assess recovery associated with the 1990 Clean Air Act Amendment (CAAA). Preliminary analysis of changes between 1984-1987 and 1994-2005 identified mixed recoveries and several community response/recovery classes and devised a fish-community index. The U.S. Geological Survey, NYSDEC, and Syracuse University are beginning a more rigorous analysis of recent data to assess effects of the 1990 CAAA between 1984-87 and 2008-12. Water chemistry and fish-community composition, species richness, and catch-per-unit-effort (CPUE) data indicate that measureable recovery has occurred in some of the study lakes between the first and second surveys. Additional univariate and multivariate analyses of richness and CPUE data and MDS ordination of community-composition data from the three periods will be presented to determine whether the 1990 CAAA has improved water quality sufficiently to permit continued reintroduction of native fishes in lakes across the Adirondack region.

WINDOWS INTO THE PAST: MUSEUM COLLECTIONS OF FRESHWATER MUSSELS FOR THE STUDY OF LONG-TERM WATERSHED DISTURBANCE

Fritts, Andrea; Fritts, Mark; Haag, Wendell; Rypel, Andrew; DeBoer, Jason; Casper, Andrew

103DE
Monday, 18 May, 2015 10:45 - 11:00

Freshwater mussels comprise a diverse fauna with multistage life histories. Their shells provide a unique opportunity to conduct investigations of historical changes in aquatic ecosystems. Mussels deposit annual growth rings in their calcareous shells, much like tree growth rings, so that shells from archeological and museum collections can serve as records of long-term environmental change over the past 1000 years. We used sclerochronology techniques to evaluate changes in age-and-growth patterns in two mussel species collected from the Illinois River near Havana, IL from 1894-2013 as well as archaeological shells from circa 1000 A.D. Age-and-growth analyses indicated that modern animals are growing at a 50% greater rate and reaching a maximum size that is 20 mm larger than their 1894 counterparts. We also used mussel shells to evaluate changes in stable isotopes and legacy contaminants over the same time period. By constructing a historical biochronology response to environmental changes, we can better understand the dynamics of aquatic systems and the recovery rate after substantial perturbations and restoration efforts.

ARE ENGINEERING EFFECTS OF CRAYFISH ON GRAVEL BED MORPHOLOGY MEDIATED BY SPECIES IDENTITY, BEHAVIOR, AND BODY SIZE?

Albertson, Lindsey; Daniels, Melinda

101CD
Monday, 18 May, 2015 10:45 - 11:00

Incorporating animal behavior and traits into biophysical frameworks is critical to quantitatively link ecological and physical processes. To investigate the impacts of ecosystem engineer behavior and size on gravel movement, we used a laboratory experiment to manipulate the presence/absence of spiny cheek crayfish (Orconectes limosus) of either 15 (young-of-the-year) or 25 mm (1+ year old) carapace length. Using videography, we found that crayfish frequently displayed territorial behaviors and 73% of interactions, on average, were aggressive regardless of size. Larger crayfish created significantly more pit structures and surface gravels were moved over 10% of the bed area compared to just 1.3% in smaller crayfish treatments and 0.003% in controls without crayfish, suggesting that young crayfish are less effective gravel engineers. We then manipulated the presence/absence of large, invasive rusty crayfish (Orconectes rusticus) in a field experiment and found that in treatments with rustys, 10% of the bed surface was moved, fine sediment accumulation was 2x lower, and macroinvertebrate density was 1.5x higher compared to controls without crayfish. We hypothesize that crayfish may indirectly increase macroinvertebrate abundance by reducing fine sediment accumulation.

PHARMACEUTICAL AND PERSONAL CARE PRODUCTS IN URBAN STREAMS AS AN UNDERSTUDIED DIMENSION OF FUTURE FRESHWATERS

Rosi-Marshall, Emma ; Lee, Sylvia; Kelly, John; Kaushal, Sujay

101A
Monday, 18 May, 2015 10:45 - 11:00

Pharmaceutical and personal care products (PPCPs) are ubiquitous in surface waters. Urban aquatic ecosystems in particular contain PPCPs in complex mixtures from numerous sources. PPCPs may influence urban ecosystems in complex ways. Although commonly detected, the role of these compounds as drivers of change in aquatic ecosystems represents a scientific opportunity for ecological research. We will discuss research frontiers in urban stream ecology and the extent to which novel contaminants may interact with other urban stressors to drive ecological processes. For example, research indicates that PPCPs influence communities, as resistance, community structure and ecosystem function. Data demonstrate urban stream microbial communities may be more tolerant to PPCPs than those in less urban streams. In addition, aquatic organisms may be developing resistance to PPCPs and widespread occurrence of PPCPs may be leading to altered microbial communities with potential consequences for ecosystem function. We conclude that PPCPs may be strong drivers of the structure and function of urban streams and ignoring the ecological consequences of PPCPs will ultimately limit a thorough understanding of many aquatic ecosystems.

SEASONAL DENITIRFICATION AND NITROGEN REMOVAL CAPACITY OF SMALL RESERVOIRS

Bender, Bree; Herrman, Kyle

102C
Monday, 18 May, 2015 10:45 - 11:00

Research has shown that aquatic ecosystems with high hydraulic residence times (e.g., wetlands and reservoirs) can be important nitrogen sinks via denitrification. The objective of this study was to examine denitrification rates and the nitrogen removal capacity each month in three small to mid-sized reservoirs (Jordan Pond, Springville Pond, and McDill Pond) in central Wisconsin between May and September of 2014. A two-way ANOVA determined that Jordan and Springville Ponds had significantly higher denitrification rates (4.97 and 4.59 mg N m-2 hr-1, respectively) than McDill Pond (2.71 mg N m-2 hr-1). In addition, Springville Pond had the highest hydraulic residence time (6.8 days) but surprisingly it had the lowest nitrogen removal capacity (3.5%) compared to Jordan Pond (10.3%) and McDill Pond (9.6%). We determined that nitrogen removal via denitrification was insignificant in Springville Pond due to the high incoming nitrate concentration (7.9 mg N L-1). Results from this study suggest that reservoirs in central Wisconsin can become nitrate saturated and in such cases appear to remove significantly lower amounts of nitrate than predicted.

PHYTOREMEDIATION OF HEAVY METAL-POLLUTED AQUATIC ECOSYSTEM (OLOGE LAGOON) BY WATER HYACINTH (EICHHORNIA CRASSIPES [MART.] SOLMS) AND THE SOCIO-EGOLOGICAL IMPLICATIONS

NDIMELE, CHINATU CHARITY; CHUKWUKA, KANAYO STEPHEN; Whenu, Olusegun Olufemi; Erondu, Ebere Samuel; NDIMELE, PRINCE EMEKA

103C
Monday, 18 May, 2015 10:45 - 11:00

The indiscriminate discharge of industrial effluents containing harmful substances such as heavy metals has become a global problem. Water hyacinth has been considered a menace since it entered Nigerian inland waters. This study investigated the ability of water hyacinth in passive phytoremediation of heavy-metal polluted aquatic ecosystems and the socio-ecological effects of the plant's invasiveness. The study was conducted over a period of 18 months (July, 2013 – December, 2014) and 5 sampling stations (Owo River, Agbara, Otto Jetty, Morogbo and Etegbin) were chosen based on proximity to points of discharge of effluents, presence of water hyacinth and human activities. The metals investigated are Cu, Zn, Pb, Fe, Cd and As. The result showed that water hyacinth absorbs heavy metals from its environment and the rate of absorption depends on concentration of the metal. It was also discovered that the presence of water hyacinth and illegal sand mining has adversely affected the delivery of ecosystem services such as fisheries, tourism etc. The consequences of these unregulated anthropogenic actions are loss in biodiversity, food insecurity and ultimately threat to human lives.

NEON AQUATIC ORGANISMAL SAMPLING: STRATEGIES AND LESSONS LEARNED FROM YEAR ONE

Parker, Stephanie

103AB
Monday, 18 May, 2015 10:45 - 11:00

The National Ecological Observatory Network (NEON) is a national-scale research platform designed to assess the impacts of climate change, land-use change, and invasive species on ecosystem structure and function across 20 ecoclimatic domains from Alaska to Puerto Rico. Data collected from instrumentation and observations will be rigorously quality-checked and provided to the public via NEON's web portal. NEON's aquatic program includes 25 wadeable streams, 8 lakes, and 3 large rivers, as well as 10 STREON sites co-located with existing wadeable stream sites. Aquatic organismal sampling began in 2014 at three wadeable streams and four lakes using NEON standard sampling protocols. The lessons learned from the training process, the first round of protocol, and preliminary data quality at the these seven sites have been instrumental in updating and streamlining the NEON aquatic standard protocols and sampling strategy. An additional 20 sites will be sampled in 2015, with aquatic organismal sampling beginning at the remaining 19 sites in 2016. By 2017, full operational sampling will be in place at all 46 aquatic sites, including instrumentation, observational sampling, and the STREON experiment.

CHARACTERIZING ECOSYSTEM SERVICE BUNDLES FOR ANALYZING TRADEOFFS IN WATERSHED MANAGEMENT

Castro, Antonio J. ; Vaughn, Caryn C.; Julian, Jason P.

103C
Monday, 18 May, 2015 11:00 - 11:15

A key challenge of watershed management is determining how to manage multiple ecosystem services across landscapes. Enhancing important provisioning services, such as food production and drinking water, often leads to tradeoffs between regulating and cultural ecosystem services, such as water purification, habitat quality, carbon sequestration, and tourism. Ecosystem service bundles are defined as areas on a landscape where ecosystem management produce sets of ecosystem services. This is the case for the Kiamichi River watershed in southeastern Oklahoma, which provides many essential benefits to local residents, visitors and a nearby urban area (Oklahoma City). We used mapping techniques and contingent valuation methods to identify community perceptions and economic values of ecosystem services including freshwater provision, water regulation, air quality, habitat for species, and recreation. Our results identified areas with similar capacity to provide sets of services, and showed significant differences in how ecosystem services beneficiaries perceived their social and economic value. Overall, we found strong relationships among the capacity of a watershed to provide services and social perception of those services

ENVIRONMENTAL DRIVERS OF DENITRIFICATION IN NORTH CAROLINA STREAMS AND RIPARIAN ZONES

Welsh, Molly; McMillan, Sara; Vidon, Philippe

102C
Monday, 18 May, 2015 11:00 - 11:15

Agricultural land use practices adversely impact streams resulting in channelization, erosion, and sedimentation, while excess nitrogen (N) from agricultural runoff can cause eutrophication, algal blooms, and widespread anoxia in water systems. Though in-stream restoration strategies are often designed to reduce stream bank erosion, they may have the added benefit of improving water quality through denitrification. This study measured denitrification enzyme activity (DEA) across the riparian-to-stream continuum in distinct geomorphic features. This work was conducted in restored and unrestored stream reaches in two agricultural catchments of the Piedmont region of North Carolina. Potential environmental drivers of denitrification (e.g., water chemistry, organic content of soils, soil moisture) were also determined. Across all sites, DEA was significantly higher in the riparian zone than in the stream ($p < 0.001$), while dormant season DEA was significantly higher than growing season DEA ($p < 0.001$). Our results highlight the importance of soil texture in stream sediments and percent moisture and organic carbon in the riparian zone in controlling DEA. This study also illustrates the importance of stream-floodplain connectivity and riparian buffers in improving water quality.

DIVERSITY AND COMMUNITY STRUCTURE OF BENTHIC INVERTEBRATES BASED ON GIS-DERIVED HABITAT MAPS IN THE NIAGARA RIVER

Mehler, Knut; Karatayev, Alexander Y. ; Burlakova, Lyubov E.

103DE
Monday, 18 May, 2015 11:00 - 11:15

Benthic habitat mapping has great potential to increase our understanding of the spatial distribution of benthic communities in large rivers. We used bathymetric data based on side scan sonar and GIS software to create habitat maps in the lower Niagara River. These maps will be used to link the distribution of physical habitat characteristics, such as water depth, sediment size, and organic matter content with biological information obtained from direct benthic sampling. Physical habitat maps were created in ArcMap 10.1 and benthic samples were taken proportionally from all identified habitats based on substrate classes. The data on species composition, density, and biomass were used to employ benthic community biological indices for the various types of identified habitats. Results from this study will help to evaluate the current status of benthic community in different habitats and select valuable habitats for conservation in the Niagara River. The benthic maps can also serve as a basis to identify quality habitats from which effective management strategies in the Niagara River ecosystem can be developed.

THE EFFECTS OF PERIPHYTON FATTY ACIDS ON GRAZER LIPID COMPOSITION AND GROWTH IN SUBTROPICAL STREAMS

Guo, Fen; Kainz, Martin; Sheldon, Fran ; Bunn, Stuart

102DE
Monday, 18 May, 2015 11:00 - 11:15

Dietary polyunsaturated fatty acid (PUFA) compositions are important for herbivores, not only limiting somatic growth but also affecting energy transfer to higher trophic levels. In a study of subtropical streams in Australia, we manipulated four different food bases by inducing two light levels and two nutrient regimes to investigate the effect of periphyton PUFA on gazer lipid composition and growth. After 6 weeks, periphyton PUFA content changed considerably and differed in each food base. The alteration of gazer PUFA composition generally followed the pattern of periphyton PUFA. Both periphyton and grazers (Austrophlebioides and Helicopsyche) accumulated more linoleic acid (LIN) in food bases with high light levels, but increased their content of eicosapentaenoic acid (EPA) in food bases with low light intensity. An exception was observed in the food base with low light intensity and enriched nutrient where grazers grew faster compared with other bases. When dietary EPA increased, stream grazers tended to invest more in growth rather than retention. Our study indicated that even under food limited conditions, changes in grazer PUFA composition is still consistent with dietary PUFA pattern.

HEATING UP FLATHEAD LAKE: MODELING THERMAL PROPERTIES UNDER A CHANGING CLIMATE

Devlin, Shawn; Ellis, Bonnie; Stanford, Jack

103AB
Monday, 18 May, 2015 11:00 - 11:15

Flathead Lake is the largest freshwater lake in the western US and is one of the most pristine water bodies in the world. Although possible increases in nutrient loading and the introduction of invasive species may shape the future of Flathead Lake, climate change is a guaranteed concern that could affect the biogeochemistry and ecology of Flathead Lake. We used a hydro-thermodynamic model (ELCOM) and climate projection models to investigate how climate change may alter the thermodynamics of Flathead Lake. After determining that the model simulates current thermal properties of the lake to a high degree of accuracy (R2=0.97), we tested if changes in climate could affect the overall heat budget, depth of stratification, length and strength of stratification, and investigated changes in thermal habitat of key lake biota. Warmer temperatures led to deeper thermoclines, whereas, increased wind speeds and higher wind direction variability lead to increased mixing events. Climate change will influence future lake thermal properties, and potentially impact the biogeochemistry and biotic habitats, despite the protections offered by the pristine and remote location of Flathead Lake.

OUR FRESHWATER FUTURES: GARBAGE

Hoellein, Timothy

101A
Monday, 18 May, 2015 11:00 - 11:15

Humans introduce synthetic materials into freshwaters that span a size gradient from dissolved compounds such as pharmaceuticals, to suspended particles like nanomaterials, microplastic, (i.e., <5 mm particles), and garbage (i.e., anthropogenic litter; AL). Because it is visually conspicuous and abundant worldwide, the study of AL is a rapidly growing field in marine ecology. Marine AL has several fates, including accumulation on coastal and benthic zones, ingestion, and breakdown into smaller pieces. Rivers are cited as a major source of AL to oceans, but the sources, movement, retention, and interactions of AL with riverine biota are rarely studied. Thus, the ecology of AL in rivers is a critical, but unknown piece of the global AL “life cycle.” I will present research on AL and microplastic ecology in rivers. These data will be placed in the context of well-studied marine habitats, with conceptual models to guide future studies. I will also discuss my experience conducting research spanning disciplines of marine ecology, freshwater science, and polymer chemistry. These data and conceptual approaches should contribute to tools that reduce AL abundance and ecosystem impacts.

FISH INTRODUCTION, FACILITATED BY UNEXPECTED RECOVERY FROM ACIDIFICATION, CAUSES A TROPHIC CASCADE IN LAKE MINNEWASKA, NY

Albers, Ben; Charifson, David; Stanson, Valerie; Stern, Erich; Thompson, John; Richardson, David

102B
Monday, 18 May, 2015 11:00 - 11:15

Lakes within managed forests are largely protected from the impacts associated with human-dominated land uses, and thus present an opportunity to study the indirect impacts of humans on lake ecosystems. We link acid rain and fish introductions as the drivers of lake ecosystem change in the Sky Lakes, a collection of five lakes within managed lands on the Shawangunk Ridge in New York State. First, we used long-term data to determine how lake pH is changing over the past 25 years in the Sky Lakes. Our three focal lakes all showed decreases in lake acidity but at significantly different rates indicating multiple drivers of this change. Second, we asked if a newly introduced fish species into a previously fishless lake (Lake Minnewaska) has caused ecosystem wide changes to the lake structure and function. A trophic cascade resulted in increased algal biomass and decreased water clarity mediated by decreasing zooplankton size and biomass. Together, increasing pH and an introduced species have combined to change the ecological community and function in a popular recreational lake.

NEW NEAR-GLOBAL 1 KM SPATIALLY CONTINUOUS FRESHWATER ENVIRONMENTAL VARIABLES FOR BIODIVERSITY ANALYSES AND SPECIES DISTRIBUTION MODELING

Domisch, Sami; Amatulli, Giuseppe; Jetz, Walter

101B
Monday, 18 May, 2015 11:00 - 11:15

The lack of spatially continuous freshwater-specific environmental variables hamper comparative biogeographical analyses across large spatial gradients and on a fine spatial grain. We developed a near-global 1 km spatially continuous data set for freshwater environmental variables based on the HydroSHEDS hydrography and by delineating the sub-catchment for each 1 km grid cell along the stream network. We then related continuous global data sets on climate, topography, river topology, land cover and surface geology to each sub-catchment, and summarized each environmental variable using several metrics (average, minimum, maximum, range, sum, inverse distance-weighted average and sum). Further, we extended the variables of the river network to lakes and reservoirs of the Global Lakes and Wetlands Database. Finally, we summarized the monthly climatic variables to 19 long-term hydro-climatic variables following the 'bioclim' framework to provide input data for species distribution models. This newly developed set of continuous river network variables provides an improved basis for analyzing and mapping freshwater biodiversity on a near-global extent yet on a fine spatial grain.

TOPOGRAPHY ALTERS TREE GROWTH – CLIMATE RELATIONSHIPS IN A SEMI-ARID FORESTED CATCHMENT

Barnard, Holly; Adams, Hallie; Loomis, Alexander

101CD
Monday, 18 May, 2015 11:00 - 11:15

Topography and climate play an integral role in the spatial variability and annual dynamics of aboveground carbon sequestration. Despite knowledge of vegetation – climate – topography relationships on the landscape and hillslope scales, little is known about the influence of complex terrain coupled with hydrologic and topoclimatic variation on tree growth and physiology at the catchment scale. We determine how species-specific tree growth patterns and water use efficiency respond to interannual climate variability and how this response varies with topographic position. We found that lodgepole pine and ponderosa pine both show significant decreases in growth with water-limiting climate conditions, but complex terrain mediates this response by controlling moisture conditions in variable topoclimates. Foliar carbon isotope analyses show increased water use efficiency during drought for lodgepole pine, but indicate no significant difference in water use efficiency of ponderosa pine between a drought year and a non-drought year. The responses of the two pine species to climate indicate that semi-arid forests are especially susceptible to climate change and that topographic variability will play a significant role in determining their the future.

GROUNDWATER DEPLETION IN WESTERN GREAT PLAINS PROJECTED TO DRY 250 STREAM-KM OF FISH HABITAT IN THE NEXT 45 YEARS

Perkin, Josh; Gido, Keith; Falke, Jeffrey; Crockett, Harry; Sanderson, John; Johnson, Eric; Fausch, Kurt

101CD
Monday, 18 May, 2015 11:15 - 11:30

Across the western Great Plains of North America, groundwater pumping for irrigated agriculture has depleted regional aquifers that sustain surface flow for native fishes. This loss of surface flow and subsequent fragmentation of fish habitat has contributed to population declines for 70% of endemic fishes. We used a network of observation wells distributed across portions of Colorado, Kansas, and Nebraska to measure changes in depth to water table (DTWT) over the High Plains Aquifer during 1950-2010. Based on DTWT values, we estimated the spatial distribution of stream segments that maintained connectivity to the aquifer and therefore surface flow to support fishes. We then used the relationship between time and DTWT to project future losses in aquifer-connected stream segments. Model results suggest >500 stream-km in the Republican River watershed disappeared during 1950-2010 as aquifer levels fell, and an additional 250 km will be lost by 2060 if withdrawal practices are not modified or reduced. We synthesize the ecological consequences of past and expected future changes in surface flow using existing fish assemblage data collected from across the region.

QUANTIFYING THE EFFECTS OF ENVIRONMENTAL VARIABLES ON THE COMPOSITION AND ACTIVITY OF DENITRIFYING MICROBIAL COMMUNITIES

Tomasek, Abigail; Hondzo, Miki; Kozarek, Jessica ; Sadowsky, Michael

102C
Monday, 18 May, 2015 11:15 - 11:30

Denitrification hot spots, or small areas of enhanced denitrification activity, frequently account for a high percentage of overall denitrification in streams and floodplains. This research aims to identify and quantify parameters that enhance denitrification hot spots. Investigated parameters include the influence of carbon type and concentration, flow characteristics, and flooding frequency and duration. This research is of significance in the upper Midwest due to the elevated nitrate concentrations in agricultural regions, which causes degradation of water quality and health concerns. Results will be presented from flume, field, and a controllable outdoor experimental stream experiments. The denitrification potential of each sediment sample was determined using the denitrification enzyme activity (DEA) assay and the abundance of denitrifying genes was quantified using qPCR. Integrating the denitrification potential with the quantity of denitrifying genes provides insight into the effect of environmental variables on both the composition and activity of microbial communities and provides a microbial processed based understanding for sustainable surface water management to promote denitrification.

EFFICACY OF DIRECT APPLICATION LIMING FROM A METAPOPULATION PERSPECTIVE

Wingerter, Natasha

102B
Monday, 18 May, 2015 11:15 - 11:30

Direct application stream liming is commonly used to treat the legacy effects of acid deposition, but its efficacy has been questioned due to the lack of fish recovery with treatment. When considering effectiveness, connectivity to neutral streams is rarely considered, and Brook Trout (Salvelinus fontinalis) populations are treated as closed entities. If Brook Trout utilize poor breeding habitat for superior foraging habitat and move between populations, liming should be continued to support the highly mobile, landscape level population. I sampled Brook Trout population parameters (density, biomass, and age structure) and diet (via gut contents and stable isotopes) in six central Appalachian mountain streams. While most water chemical conditions in treated stream reaches corresponded to naturally neutral reference streams, fish (density, biomass, age class structure) were similar to untreated acidic streams. Gut contents of Brook Trout did not vary among treatments; however isotope signatures of their muscle tissue indicated different food sources and trophic position among treatments. Considering the dynamics of an open system, these results support that there is movement between patch populations for optimal foraging and decreased competition.

RELATIONSHIP BETWEEN ECOLOGICAL STOICHIOMETRY AND BIOCHEMICAL COMPOSITION IN A LAKE PHYTOPLANKTON COMMUNITY.

Grubaugh, Catharina; Wehr, John

102DE
Monday, 18 May, 2015 11:15 - 11:30

Elemental stoichiometry and biochemical composition both describe the nutritional quality of a food resource. While stoichiometry quantifies the elemental composition of the food source, usually with C:N, C:P, and N:P ratios, the biochemical composition refers to the protein, lipid, and carbohydrate contents as well as fatty acid (FA) composition. However, the relationship between these two metrics of nutritional quality is unclear, and understanding this link is key to fully understanding food web dynamics. Employing 21, 5400-liter lake mesocosms housed in the outdoor Experimental Lake Facility at Fordham University's Calder Biological Field Station, we conducted a nutrient enrichment experiment with a phytoplankton assemblage. We added varying amounts of inorganic N and P to create seven treatments with target molar N:P supply ratios between 2.6 and 70. We predicted that changes in biochemical composition will mirror changes in elemental ratios: seston with the highest concentrations of proteins, lipids, and essential FAs will also have the lowest C:N and C:P ratios.

DROUGHT AND SALTWATER INTRUSION IN FRESHWATER ECOSYSTEMS: EMERGING THREATS THAT TAKE THE FUTURE OF OUR SCIENCE BELOWGROUND

Kominoski, John

101A
Monday, 18 May, 2015 11:15 - 11:30

Freshwater aquifers from Florida to Texas to California are being rapidly depleted, especially during droughts. Saltwater intrusion is irreversibly decreasing the freshwater storage capacity of near-coastal aquifers with negative impacts on dependent ecosystems and human populations. These emerging threats will increase with human population growth and climate-driven increases in sea-level rise. In the near future, freshwater scientists will be challenged to vastly enhance our understanding and protection of fresh groundwater. Already private and public projects to increase belowground freshwater storage are occurring, in arid regions like the Mohave Desert and Rio Grande Valley, through use of interbasin transfers of surface and groundwater without consideration of current or projected demands or ecological impacts. In South Florida, fresh water is wasted to the ocean to mitigate flooding into metropolitan Miami. That fresh water recharges the Florida Everglades and Biscayne aquifer that 90% of Floridians rely upon for drinking water and supports year-round agriculture. Despite apparent growing economic demands, U.S. freshwater withdrawals have decreased and GDP increased since 1970. The future is now. Sustainable water use today will protect groundwater for tomorrow.

SPATIAL AND TEMPORAL PROCESSES INFLUENCE STRUCTURE OF LARGE RIVER BENTHIC COMMUNITIES

McTammany, Matthew; Wilson, Matthew; Walters, Elizabeth; Reilly, Meghan

103DE
Monday, 18 May, 2015 11:15 - 11:30

Processes structuring benthic communities interact across space and time to link organisms from multiple locations within river networks. However, broad scale studies of community dynamics typically use data from a single sampling date, causing us to attribute ecological patterns over space to processes operating on different temporal scales. We investigated temporal changes in community dynamics by surveying benthic communities over three consecutive years from twenty-seven patches within three riffles spanning 14 km of the West Branch Susquehanna River. We then compared relative influences of spatial orientation, distance between sites, local environmental factors, and inter-annual variability of community structure in these patches. Preliminary data suggest the most abundant genera were spatially consistent through time although there was high inter-annual variability in densities of closely related and dominant genera (e.g. Cheumatopsyche and Hydropsyche). Certain taxa were only found in particular years but had ubiquitous distributions and low abundance (e.g. Neophylax and Epeorus). Our results indicate while influence of certain processes may be consistent through time (e.g. species sorting) others are temporally sensitive and strongly dependent on stochasticity and dispersal.

COMBINING RESULTS FROM FIELD OBSERVATIONS AND EXPERIMENTS TO INFORM MANAGEMENT STRATEGIES FOR A HEAVILY USED LAKE WITH LOTS OF PROBLEMS

Steinman, Alan; Ogdahl, Mary; Weinert, Maggie ; Gillett, Nadia

103C
Monday, 18 May, 2015 11:15 - 11:30

Silver Lake is a small, mesotrophic lake in western Michigan (USA) that has experienced fish kills and cyanobacterial blooms (Gloeotrichia) during the past four years. The lake and its affiliated state park are tourist destinations because of its location adjacent to Lake Michigan and large sand dunes, which attract approximately 20,000 visitors each summer. To address homeowner concerns about deteriorating water quality, a 3-year study was initiated consisting of external and internal nutrient load determination, bioassays to assess nutrient limitation (control, +P, +N, +N+P), and cyanotoxin analyses. Data from the year one field campaign indicated that internal phosphorus loading was negligible. The bioassay results indicated that plankton appear to be N+P co-limited, neither Gloeotrichia nor microcystin levels responded significantly to nutrient amendments, and microcystin concentrations remained below World Health Organization standards for recreational water use, regardless of treatment. USGS scientists are measuring surface inflow and groundwater nutrient loads; data will be compiled to create nutrient budgets and determine sources.

COUPLED CHANGE: EXTREME WEATHER AND LAND USE IMPACTS ON WATER QUALITY AND DRINKING WATER UTILITIES

Parr, Thomas; Inamdar, Shreeram; Miller, Matthew

103AB
Monday, 18 May, 2015 11:15 - 11:30

Sustaining ecosystem services, like clean water will become an increasing challenge as human populations grow. This challenge is exacerbated by the interactive processes of land use change and climate change. Changes in storm intensity, frequency, and timing may interact with changes in land use and management to change the ambient concentrations of dissolved organic carbon ([DOC]) in streams. To assess the effects of these global change processes on stream [DOC], we assessed a 10+ year record of sub-daily [DOC] measurements from the Brandywine River. The Brandywine River is the drinking water supply for the city of Wilmington Delaware and [DOC] affects the city's ability to sustainably supply water. Over this record, we observed a change in storm and low flow [DOC] as well as a shift in seasonality of DOC concentrations. Changing the timing and quantities of DOC in streams may affect ecosystem processes as well as affect the engineering processes linked to the provision of drinking water. The results of this research highlight the importance of understanding the impacts land use and climate change on water quality.

ASSEMBLAGE PREDICTABILITY AND BETA DIVERSITY IN STREAM ECOSYSTEMS: MACRO-SCALE EFFECTS OF ENVIRONMENTAL HETEROGENEITY, ISOLATION, AND PRODUCTIVITY

Hawkins, Charles; Vander Laan, Jacob

101B
Monday, 18 May, 2015 11:15 - 11:30

We used macroinvertebrate data collected from 3,265 streams in 68 ecoregions across the USA to assess how both assemblage predictability (precision of multi-taxon niche models) and beta diversity (compositional dissimilarity among sites) varied with regional environmental heterogeneity, isolation (drainage density), and productive capacity (total nitrogen [TN] and total phosphorus [TP]). For reference quality streams, assemblage predictability declined with increasing isolation (drainage density range = 0.1-0.7 km/km2) and TN (asymptote ~300 µg/L, range = 20-500), but was unrelated to environmental heterogeneity. A model that included degraded sites was ~10% less precise than a reference site model. For reference-quality streams, beta diversity (adjusted for alpha diversity, gamma diversity, and region size) increased with TN (asymptote ~300 µg/L), TP (range = 5-50 µg/L), isolation, and environmental heterogeneity. Across all streams, beta diversity increased with both TN (asymptote ~300 µg/L, range = 20-5000) and TP (asymptote ~200 µg/L, range = 5-800) but was only weakly related to isolation and environmental heterogeneity. These results imply that the importance of different processes in community assembly/disassembly vary with both natural environmental setting and human-caused increases in productivity.

EXPERIMENTAL NUTRIENT ENRICHMENT OF HEADWATER STREAMS ALTERS FOODWEB PATHWAYS TO LARVAL SALAMANDERS

Bumpers, Phillip M. ; Rosemond, Amy D. ; Maerz, John C.; Benstead, Jonathan P.

102DE
Monday, 18 May, 2015 11:30 - 11:45

Bottom-up perturbations can influence predators indirectly via effects on their prey. We tested the effects of nutrient enrichment on larval salamander diets in five streams that received experimental nitrogen (N) and phosphorus (P) additions at moderate concentrations for two years. Nutrient enrichment altered diet composition of Desmognathus quadramaculatus (PERMANOVA P = 0.007). Little detectable changes were found for Eurycea wilderae (PERMANOVA P = 0.06), possibly due to microhabitat preferences. Changes in D. quadramaculatus diet composition, measured a functional group biomass of prey, were related to shifts in the basal resources of prey taxa. Biomass of shredder prey decreased, while that of biofilm consumers increased in salamander guts; these shifts were related to corresponding changes in the quanitity of respective primary food resources (leaves, P = 0.005, R2 = 0.47; biofilm, P = 0.08, R2 = 0.15). Although our study streams were detritus-based, small increases in biofilm availability with enrichment were linked to diet changes at the highest trophic level, altering energetic pathways to salamanders and likely contributing to the increased salamander growth rates observed with nutrient enrichment.

COMPARISON OF DIEL NITROGEN FIXATION FLUX MEASUREMENTS

Madinger, Hilary; Kunza, Lisa; Hall, Robert O.; Haueter, Jaime

102C
Monday, 18 May, 2015 11:30 - 11:45

In streams with low nitrate concentrations, nitrogen fixation is a dominant process to form biologically available nitrogen for biofilm growth. Diel patterns in nitrogen fixation will control the net nitrogen flux. Acetylene reduction assays are an indirect method of measuring nitrogen fixation by assessing nitrogenase activity while membrane-inlet mass spectrometers (MIMS) directly measure nitrogen gas concentration and net nitrogen fixation. To compare diel nitrogen fixation methods, we incubated chamber assays to measure acetylene reduction and the change in nitrogen, oxygen, and argon gases to calculate net nitrogen fixation using MIMS in oligotrophic Wyoming streams. Nitrogen fixation estimated via acetylene reduction ranged from 0.043 mg N2 m-2 hr-1 at night to 0.24 mg N2 m-2 hr-1 fixed during the day. Net nitrogen fixation using the MIMS technique was much higher than the acetylene reduction method and ranged from 0.39 mg N2 m-2 hr-1 to -3.59 mg N2 m-2 hr-1 and was related to increased solar radiation and net ecosystem productivity which ranged from -18.59 mg O2 m-2 hr-1 to 101.77 mg O2 m-2 hr-1.

EFFECT OF STREAM HYDROLOGY AND RIPARIAN VEGETATION ON TERRESTRIAL ARTHROPOD COMMUNITY STRUCTURE AND WATER VS ENERGY LIMITATION IN DRYLAND FLOODPLAINS

Allen, Daniel

101CD
Monday, 18 May, 2015 11:30 - 11:45

Intermittent rivers comprise over 30% of the Earth's flowing water bodies, including 60% of total river length in the contiguous United States. Because stream and groundwater hydrology governs riparian vegetation composition in dryland ecosystems, we might expect different hydrologic regimes to generate microclimatic conditions that are either more arid or more mesic due to vegetation differences, where either water or energy could be more limiting to riparian food webs. Here I present the results of a replicated field experiment where I manipulated the availability of water and energy to 3 riparian floodplains on the San Pedro River in Arizona that varied in intermittence and riparian vegetation. Each site had significantly different terrestrial arthropod communities, differences that were largely driven by site differences in microclimate. Moreover, I found that the water effect size on cricket abundance increased with aridity, and that the the energy effect size on ant abundance decreased with aridity. These results suggest that riparian communities along perennial streams may function very differently than those along intermittent streams, and are subject to a different set of ecological controls.

QUANTIFYING THE PROCESSING OF LARGE WOODY DEBRIS BY LARVAL CADDISFLIES IN THE UPPER MISSISSIPPI RIVER

Haro, Roger

103DE
Monday, 18 May, 2015 11:30 - 11:45

Large woody debris (LWD) provides critical habitat for fish and macroinvertebrates in large river systems. Wood processing by larval filter-feeding caddisflies is documented, but not yet quantified. An experiment was conducted to determine if caddisfly wood-processing rates differed by wood type (i.e., hard vs. soft). Processing rates were expected to be greater on soft wood (poplar) than on hard wood (oak). Unenclosed, pre-weighted substrates for both wood types (treatments) and controls (substrates in exclosures) were placed mid-water in a main-channel border area of the Upper Mississippi River (UMR) for 113 days. Numerous pits from caddisfly excavation were found on both treatment substrates. Control substrates were not pitted. Poplar and oak substrate treatments lost an average of 10.5% and 6.2% of their original weight, respectively. Differences in the average-percent weight loss between wood types was significant ($P = 0.03$). Processing of LWD by larval filter-feeding caddisflies is an important ecosystem service that may be functioning throughout the Mississippi River.

THE 411 ON VULNERABILITY ASSESSMENT – SPECIFIC LESSONS FROM CLIMATE CHANGE ASSESSMENTS IN STREAMS

Bierwagen, Britta; Julius, Susan; Hamilton, Anna; Witt, Jonathan

103AB
Monday, 18 May, 2015 11:30 - 11:45

The broadening mandate for adaptation planning across federal agencies requires general adaptation goals to be translated into a specific approach for prioritizing and implementing adaptation actions. Vulnerability assessment can help this process by operationalizing the most basic units of vulnerability – exposure, sensitivity, and adaptive capacity –to meet situation-specific needs. Using an example for streams, we illustrate an 8-step vulnerability assessment: (1) defining goals; (2) determining approach for assessing endpoints; (3) brainstorming variables to assess each vulnerability component; (4) conducting data inventory; (5) assessing data quality, availability and suitability; (6) conducting analyses; (7) soliciting feedback from stakeholders; and (8) finalizing results for implementation. Both qualitative and quantitative approaches can yield sufficient information to guide environmental management. An important application of qualitative approaches is the selection of exposure scenarios relevant to the system. Quantitative approaches are useful to produce comparative rankings of vulnerability to specific exposures or in modeling to explore threshold shifts in community composition, stream classification, and use designations. Often vulnerability assessments need to be a combination of qualitative and quantitative approaches in order to address environmental management needs.

CHEMICAL AND BIOLOGICAL RECOVERY FROM ACID DEPOSITION WITHIN THE HONNEDAGA LAKE WATERSHED, NEW YORK, USA

Kraft, Clifford; Josephson, Daniel; Jirka, Kurt

102B
Monday, 18 May, 2015 11:30 - 11:45

The recovery of heritage brook trout in a 312 ha Adirondack lake subject to extensive acidification provides a comprehensive example of the response of an aquatic ecosystem to the Clean Air Act Amendments of 1990. Cornell University researchers began Honnedaga Lake studies in the 1950s, but stopped surveying the lake in the 1970s when the brook trout population was considered to be functionally extirpated. Brook trout were next captured in the main body of the lake two decades later, indicating that the lake had been re-colonized from a few well-buffered tributary refuges as in-lake concentrations of sulfate, nitrate, and inorganic monomeric aluminum declined. By contrast, no changes have been observed in acid-neutralizing capacity (ANC) or calcium. Recent increases in chlorophyll a and decreases in water clarity reflect a concurrent increase in phytoplankton abundance, though the zooplankton community exhibits low species richness with a scarcity of acid sensitive Daphnia and dominance by acid-tolerant copepods. Recent surveys have documented a steady increase in brook trout abundance, reflecting an ongoing recovery of chemistry and biota in this lake.

BEYOND OUR REACH? EXTRAPOLATING NETWORK-SCALE AQUATIC METABOLISM FROM REACH-SCALE OBSERVATION

Sheehan, Ken; Wollheim, Wil; Farrell, Kaitlin; Song, Chao; Kominoski, John; Trentman, Matt; Dodds, Walter; Rosemond, Amy D. ; Ballantyne, Ford; Rueegg, Janine

103C
Monday, 18 May, 2015 11:30 - 11:45

Understanding aquatic metabolism at watershed to global scales requires extrapolation of reach-scale measurements to entire river networks. River network scale models of aquatic metabolism must account for between-reach variability of gross primary production, respiration, and related factors including reaeration and groundwater gas inputs. Key questions are how heterogeneity of metabolism drivers impacts scaling from reach to network. The Framework for Aquatic Modeling of the Earth System (FrAMES) was used to predict daily metabolism along the river continuum and test results using measured dissolved oxygen. We applied the model in two contrasting watersheds, upper Coweeta Creek (16.3 km2), NC, and Kings Creek (15.3 km2), KS. Model drivers were parameterized using field measurements or empirical relationships between metabolism processes and drivers. Results indicate heterogeneity of aquatic metabolism drivers at the reach-scale impacts network-scale metabolism estimation. The validated model allows translation of small-scale, reach-based aquatic metabolism to entire watersheds, an important step towards expanding our understanding of aquatic metabolism from highly local to regional to cross biome scales.

ASSEMBLAGE PREDICTABILITY AND BETA DIVERSITY IN STREAM ECOSYSTEMS: MACRO-SCALE EFFECTS OF ENVIRONMENTAL HETEROGENEITY, ISOLATION, AND PRODUCTIVITY

Hawkins, Charles; Vander Laan, Jacob

101B
Monday, 18 May, 2015 11:30 - 11:45

We used macroinvertebrate data collected from 3,265 streams in 68 ecoregions across the USA to assess how both assemblage predictability (precision of multi-taxon niche models) and beta diversity (compositional dissimilarity among sites) varied with regional environmental heterogeneity, isolation (drainage density), and productive capacity (total nitrogen [TN] and total phosphorus [TP]). For reference quality streams, assemblage predictability declined with increasing isolation (drainage density range = 0.1-0.7 km/km2) and TN (asymptote ~300 µg/L, range = 20-500), but was unrelated to environmental heterogeneity. A model that included degraded sites was ~10% less precise than a reference site model. For reference-quality streams, beta diversity (adjusted for alpha diversity, gamma diversity, and region size) increased with TN (asymptote ~300 µg/L), TP (range = 5-50 µg/L), isolation, and environmental heterogeneity. Across all streams, beta diversity increased with both TN (asymptote ~300 µg/L, range = 20-5000) and TP (asymptote ~200 µg/L, range = 5-800) but was only weakly related to isolation and environmental heterogeneity. These results imply that the importance of different processes in community assembly/disassembly vary with both natural environmental setting and human-caused increases in productivity.

BIG FLOOD, SMALL FLOOD, SPRING FLOOD, FALL FLOOD: HOW CONTROLLED FLOOD TIMING AFFECTS FOOD WEB RESPONSE IN THE GLEN CANYON DAM TAILWATER

Kennedy, Ted; Muehlbauer, Jeffrey; Dodrill, Michael; Copp, Adam; Yard, Michael

101CD
Monday, 18 May, 2015 11:45 - 12:00

Controlled floods are an important tool in river rehabilitation and restoration efforts worldwide. These floods have the potential to rehabilitate rivers by restoring geomorphic processes, disadvantaging non-native taxa, and returning a key component of the natural disturbance regime necessary for many aquatic organisms. Controlled floods have been released from Glen Canyon Dam on the Colorado River 6 times since 1996. Research conducted around the March 2008 flood demonstrated that this pulse disturbance reduced biomass and cover of aquatic macrophytes, and restructured invertebrate assemblages by favoring fast-growing insect taxa that prefer bare substrates and disadvantaging non-native and non-insect taxa that prefer macrophyte beds. In the years after this controlled flood (2009-2012), aquatic macrophytes returned, large bodied non-native taxa came to dominate, and fast-growing insect taxa declined. Controlled floods were again conducted in November 2012, 2013, and 2014, but these fall-timed floods did not restructure invertebrate assemblages, likely due to the seasonal scouring potential of aquatic macrophytes. Thus, the timing, rather than simply the magnitude, of controlled floods on the Colorado River affects food web response.

ASSESSING THE EFFECTS OF ALTERED LARVAL SALAMANDER DENSITY ON ECOSYSTEM PROCESSES IN A HEADWATER STREAM

Farrell, Kaitlin; Rosemond, Amy D. ; Maerz, John C.; Bumpers, Phillip M.

102DE
Monday, 18 May, 2015 11:45 - 12:00

Larval salamanders are a dominant predator in headwater streams. While the southeastern United States is a current hotspot for salamander diversity, multiple stressors including climate change, land-use change, and invasive pathogens could reduce salamander densities. We used an enclosure experiment to assess potential consequences of altered larval salamander density in a headwater stream in the Coweeta LTER. We manipulated density of larval Desmognathus quadramaculatus, with treatments ranging from 0 to ~30 individuals·m-2. We tested whether salamander density affected patch-scale measurements of ecosystem processes: primary productivity, respiration, and ammonium uptake. We predicted that salamander effects on our measurements were mediated by their effects on benthic leaf litter, and that litter breakdown rate would be inversely related to salamander density due to salamander predation on macroinvertebrate shredders. Preliminary results suggest that salamanders did not affect breakdown rates and that salamander density was not related to other measured processes. While some ecosystem functions in streams may be resilient to losses in a top consumer, understanding how to extrapolate our results to the reach-scale will also be important in predicting effects of consumer losses.

SALINITY EFFECTS ON NITROGEN CYCLING IN TIDAL WETLANDS OF THE HUDSON RIVER

Findlay, Stuart; Bernot, Melody

102C
Monday, 18 May, 2015 11:45 - 12:00

Salinity intrusion affecting tidal freshwater marshes is expected to have several effects on nitrogen cycling primarily mediated by toxic effects of sulfide (derived from sulfate reduction) on enzymes responsible for steps in the nitrogen cycle. Dissolved nitrogen in tidal exchange water was measured at five marshes spanning the fresh-brackish region of the lower Hudson River estuary. Denitrification potential was measured in sediments from these sites and an experimental manipulation of salinity was used to assess effects on nitrogen processing. The five marshes showed similar patterns in nitrate across tidal exchanges with all sites showing ebb-tide concentrations roughly half flood-tide concentrations. These patterns suggest minimal differences among sites in net nitrate removal. Experimental manipulation of salinity spanned a greater range in salt content than experienced by the field sites at times of sampling. These experiments did reveal inhibition of both nitrification and denitrification at highest levels of salinity. While high salinity clearly can affect N-cycling in these marshes the present exposure levels are apparently not causing large changes in how these marshes process nitrogen.

NUTRIENT UPTAKE DYNAMICS IN ACID-STRESSED AND LIME AMENDED ADIRONDACK MOUNTAIN STREAMS

Fuller, Randy; Haines, Grant; Paris, James; Morgan, Wesley

102B
Monday, 18 May, 2015 11:45 - 12:00

The Adirondack Mountain region of New York State continues to suffer from the effects of acid deposition and one mitigation strategy is to add pelletized limestone directly to stream channels or across entire drainage basins to neutralize incoming acid. We studied the impact of lime amendments in 5 streams, 2 are chronically acidic, and 3 are episodically acidic. Lime has been applied annually to stream channels in 2 episodically acid streams beginning in 2012, and in 2013 we aerially applied lime to a whole drainage basin of 1 chronically acid stream. We conducted short-term nutrient uptake experiments in the summer and autumn of 2014 using ammonium and phosphate and compared uptake lengths, uptake rates and uptake velocities among streams. There was no relationship between any uptake metric and level of acidity nor was there any consistent difference in uptake metrics between the summer and autumn. Uptake lengths were greater for ammonium than phosphate but that was likely the result of higher ammonium than phosphate concentrations in the streams. Our results suggest nutrient uptake is not significantly affected in acid-stressed streams.

A FRAMEWORK FOR EVALUATING RELATIVE WETLAND VULNERABILITIES TO CLIMATE CHANGE

Hamilton, Anna; Wardrop, Denice H.; Nassry, Michael; West, Jordan M.; Julius, Susan; Bierwagen, Britta; Holcomb, Megan

103AB
Monday, 18 May, 2015 11:45 - 12:00

The Environmental Protection Agency's (EPA) Office of Research and Development is developing an inventory of potential wetland responses to climate change and an associated framework for assessment of relative vulnerability. Relative vulnerabilities of wetland types and attributes could be used to inform adaptation planning and management in EPA wetlands programs. For phase one development of the framework, we used detailed quantitative inputs to estimate two of the major components of vulnerability - exposure and sensitivity. We quantified exposure as the magnitude of changes in groundwater depths, projected under historical and future climate scenarios, using the Penn State Integrated Hydrologic Model. Data were analyzed according to hydrogeomorphic wetland type for seven watersheds representing four ecoregions in Pennsylvania. We estimated sensitivity from the responsiveness of two attributes to changes in hydrology: a community composition metric (Floristic Quality Index) and wetland extent. Adaptive capacity is being considered through the potential for management actions within the context of the wetland programs being served. Relative vulnerability scores were linked to acreage profiles in a risk paradigm to provide additional management relevance.

BIOGEOCHEMICAL REGIME SHIFTS IN COASTAL LANDSCCAPES: EFFECTS OF SALTWATER INTRUSION ON CARBON AND NITROGEN CYCLING IN A COASTAL PLAIN FRESHWATER WETLAND

Helton, Ashley M. ; Ardon-Sayao, Marcelo; Bernhardt, Emily

102C
Monday, 18 May, 2015 13:30 - 13:45

As a result of increasing drought frequency, soil oxidation, and rising sea levels, low lying coastal areas are increasingly subject to episodic and seasonal saltwater intrusion. Saltwater intrusion, which raises the pH and salinity of inland freshwaters and supplies high concentrations of base cations and sulfate, is expected to dramatically alter carbon and nitrogen in affected ecosystems. We performed marine salt experimental enrichments in the field and in a complementary controlled laboratory experiment with soil cores collected from the same large freshwater wetland complex in coastal North Carolina, USA. In both experiments saltwater enrichment significantly suppressed methane emissions and reduced methanogenesis potential for saturated sediments. Effects on nitrous oxide emissions were mixed, with saltwater enrichment reducing nitrous oxide emissions in the field but tending to enhance nitrous oxide emissions in the lab. Most surprising, in contrast to the majority of published research, we found that saltwater enrichment suppressed carbon mineralization and carbon dioxide emissions in the field and lab.

GEOGRAPHIC PATTERNS OF MAYFLY DIVERSITY IN THE UNITED STATES, CANADA AND GREENLAND (INSECTA: EPHEMEROPTERA)

Jacobus, Luke M.

101CD
Monday, 18 May, 2015 13:30 - 13:45

Based on the current taxonomy and state of knowledge, 589 species of mayflies are thought to occur in North America, north of Mexico. Taking into account certain areas that are historically under-sampled or under-studied by mayfly specialists, distinct patterns of species diversity emerge. For example, even though the species richness of the entire mountainous West is comparable to some single states in the Southeast, overall generic richness in the mountainous West is relatively great, reflecting remarkable habitat adaptation of the relatively few species that occur there. The particular regions in most need of further study include the Pacific Northwest, the southern Great Plains, the Ozarks, the middle Appalachians and Atlantic Coast and the middle and lower Mississippi River Valley. The differential application of various species philosophies by taxonomists impacts our ability to understand patterns of diversity, and select scenarios where this is considered are explored.

INVASIVE BIGHEAD CARP ALTER ORGANIC MATTER EXCHANGES WITHIN AND BETWEEN ECOSYSTEMS

Collins, Scott; Wahl, David

102DE
Monday, 18 May, 2015 13:30 - 13:45

Bighead carp are a highly productive and invasive fish species. Curiously, little is known of the ecological impacts of juvenile bighead carp. We conducted an additive experiment to evaluate the direct and indirect effects of juvenile bighead carp within and between ecosystems. Ponds (0.04 ha.) were stocked with a native fish community (control, n=5) and native fishes plus juvenile bighead carp (treatment, n=5). Food web responses were quantified through time. Bighead carp greatly reduced zooplankton abundance, with indirect and cascading increases in chlorophyll-a levels. Direct competition between bighead carp and two families of shiners resulted in their reduced growth and survival. Additionally, bighead carp reduced filamentous algae and turbidity. Direct utilization of pelagic resources by bighead carp resulted in increased secondary production and rates of egestion, translocating organic matter from pelagic to benthic habitats. Consequently, increased flux of adult Chironomidae midges was observed in carp treatments. In contrast, bighead carp reduced the emergence of adult Chaoborus midges. Our experiment indicated that bighead carp could greatly alter the exchange of organic matter within and between aquatic and terrestrial ecosystems.

EFFECTS OF CONNECTIVITY ON FLOODPLAIN MACROINVERTEBRATE COMMUNITIES ON A LARGE NEW ZEALAND RIVER SYSTEM

Collier, Kevin; Garrett-Walker, Jeremy; Górski, Konrad

103DE
Monday, 18 May, 2015 13:30 - 13:45

Connectivity of rivers with floodplains is regulated in many lowland river systems worldwide to allow for human population growth and agricultural development. Disconnection of floodplains has been linked to declines in fish populations but comparatively little is known about responses of macroinvertebrate communities. We sampled macroinvertebrates in (i) terrestrial habitats characterised by different vegetation types and fed by different donor systems during a large flood, and (ii) 34 floodplain ponds during an inter-flood period. Macroinvertebrate communities in flooded terrestrial habitats were similar to those in flooded wetlands and lake outlets, and distinct from stream tributary and mainstem faunas, suggesting colonisation of inundated land predominantly from floodplain lake and wetland donor systems. In constructed floodplain ponds, macroinvertebrate community composition was affected by factors strongly associated with riverine connectivity: flood frequency, permanence, and the abundance of invasive fish. Our work highlights that achieving biodiversity returns through re-creation of natural connectivity can be compromised by the modified composition of biotic communities, and indicates that controlled connectivity with floodplains is required to achieve multiple goals.

FROM DISPERSAL ACROSS SYSTEMS TO RESTORATION ACROSS THE U.S.

Palmer, Margaret

103C
Monday, 18 May, 2015 13:30 - 13:45

Early in Dave Allan's career he was a major player in pushing forward our understanding of invertebrate drift in streams – what factors control and what the consequences are for stream organisms. Five years into my first faculty position at a small college, I took a leave of absence to work with Dave at the University Maryland to ask if we could take theory and ideas from marine systems and apply them in streams. This resulted in a very successful collaboration and eventually also a permanent move to Maryland where the rest of my career has been spent. It was some 15 years later that Dave and I spent several hours and several bottles of wine discussing the idea of a national river restoration synthesis. Eventually this became the National River Restoration Science Synthesis. The latter has had a huge impact and now ranks among one of the most cited publications coming out of an NCEAS synthesis project.

EPITHELIAL ION TRANSPORTERS: A PHYSIOLOGICAL MODEL FOR ION EFFECTS ON FRESHWATER ANIMALS

Griffith, Michael

102B

Monday, 18 May, 2015 13:30 - 13:45

Ions in freshwater animals are regulated in part by uptake from water through ionocytes on the gills or other epithelia. A literature review suggests two mechanisms for adverse effects to freshwater animals by ionoregulation. First, elevated water concentrations of other ions that can pass through specific ion transporters competitively inhibit uptake of the primary ion. Divalent metals cross epithelia via Ca^{2+}-transporters. Competitive inhibition of uptake occurs between these metals and Ca^{2+} and is the mechanistic basis of metal toxicity. Second, increased water concentrations of an ion can reduce its trans-epithelial concentration gradient inhibiting ion exchange. H^+ and HCO_3^- are hydrolyzed from CO_2 and exchanged for Na^+ and Cl^-, respectively. Elevated water H^+ levels inhibit Na^+ uptake in exchange for intracellular H^+ resulting in internal Na^+ depletion and toxicity. Similarly, elevated water HCO_3^- may inhibit Cl^- uptake in exchange for intracellular HCO_3^- resulting in Cl^- depletion. Understanding of these mechanisms underlies ion toxicity models. The views expressed in this abstract are those of the author and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency.

GLOBAL META-ANALYSIS OF TEMPERATURE EFFECT ON LEAF LITTER BREAKDOWN RATES IN STREAMS

Follstad Shah, Jennifer; Kominoski, John; Ardon-Sayao, Marcelo; Dodds, Walter; Gessner, Mark; Griffiths, Natalie A.; Johnson, Sherri; Lecerf, Antoine; LeRoy, Carri; Manning, David; Rosemond, Amy D. ; Swan, Chris; Webster, Jack; Zeglin, Lydia

103AB
Monday, 18 May, 2015 13:30 - 13:45

The response of leaf litter breakdown to elevated temperature in streams and rivers worldwide is uncertain given variation in macroinvertebrate responses to temperature and large differences in plant litter quality. Here, we synthesize 1025 records of leaf litter breakdown rates in streams and rivers, from 169 published studies, spanning latitudes of 0° to 60°, to quantify the apparent temperature dependence of leaf litter breakdown and examine how macroinvertebrate density and leaf quality affect this dependence. The global apparent activation energy of breakdown was 0.34 ± 0.04 eV, which was lower than the theoretically predicted value (~0.60 eV). This estimate was consistent for rates mediated by microbes alone and by microbes plus macroinvertebrates, contrary to previous research. Although activation energy varied across individual plant genera (n = 12), differences were not related to indicators of leaf quality. Our results suggest that rates of leaf litter breakdown may increase by 11-16% with a 2-3 °C average global increase in water temperature, but the balance of microbial and metazoan contributions to leaf litter processing is unlikely to change.

IOWA FLOOD CENTER AND IOWA NUTRIENT RESEARCH CENTER: CRITICAL RESOURCES FOR IMPROVED FLOOD AND NUTRIENT MONITORING, MODELING AND FORECASTING

Weber, Larry

101B
Monday, 18 May, 2015 13:30 - 13:45

The talk will provide an overview of two programs at IIHR – Hydroscience and Engineering at the University of Iowa. The presentation will focus on research, technology development and community outreach programs of the Iowa Flood Center (IFC) and Iowa Nutrient Research Center (INRC). The talk will describe IFC's stream monitoring, modeling and forecast systems, as well as, the Iowa Flood Information System, an advanced online web portal used to communicate complex, flood-related data to citizens, communities, emergency managers and state/federal agencies interested in understanding the natural evolution of floods. Research is focused on developing improved instrumentation for flood monitoring, advanced numerical models for flood forecasting, and a strong public outreach and education program. Similarly, the talk will highlight INRC's stream water quality monitoring network, recent trends in nutrient concentrations and loads in Iowa and advanced watershed scale models to predict impact of hydrologic events on the fate and transport of nutrients. Originating after the 2008 floods, the Iowa Flood Center is an academic-based research center focused on improving flood readiness and long-term resiliency to flood hazards. Likewise, the Iowa Nutrient Research Center was established by the Iowa Legislature as a Regents-based academic research center combining research strengths at Iowa State University, The University of Iowa and Northern Iowa University.

EVALUATING THE INVASIVE HARRIS MUD CRAB AS A PREDATOR OF ZEBRA MUSSELS

Hallidayschult, Thayer; Hambright, K. David

101A
Monday, 18 May, 2015 13:30 - 13:45

The trophic ecology of invasive species is integral to predicting their impacts, as release from predators can lead to explosive population growth outside their native range. Novel predators may act as a biological control, but quantifying their impact on invasive prey requires controlled manipulation. In the south-central United States, two invasive species, zebra mussels (Dreissena polymorpha) and Harris mud crabs (Rhithropanopeus harrisii), now coexist, with future range expansion likely. To identify factors key in regulating consumption of zebra mussels by Harris mud crabs, we conducted feeding trials to test how mussel size, crab body size, and claw morphology affected the rate and amount of mussels consumed. Larger crabs consumed more and larger mussels, but variation was high, with individual crabs consuming between 0 and 36 mussels over four days. All crabs preferred smaller mussels. Claw morphology was variable, but played a limited role in explaining variation in mussel selection. Our results suggest that Harris mud crabs may play an important role as a predator of zebra mussels, but we require an understanding of their consumption patterns to make accurate predictions.

EFFECT OF FOREST CONDITION ON FOOD WEB STRUCTURE IN HEADWATER STREAMS IN DIFFERENT REGIONS OF CANADA

Erdozain, Maitane; Kidd, Karen; Kreutzweiser, Dave; Sibley, Paul

102DE
Monday, 18 May, 2015 13:45 - 14:00

An important ecosystem service provided to headwater stream communities by forests is the provision of allochthonous energy to support biodiversity. Forest disturbance can significantly affect this subsidization, but the mechanisms are poorly understood. To address this we are studying how forest management affects food web structure (via stable isotopes and ecological stoichiometry of macroinvertebrates and their food resources) in headwater streams differing in degree of disturbance and consequent forest condition across Canada. Streams with a range in watershed disturbance were sampled in Ontario (3 logged, 3 burned, 3 reference), British Columbia (6 clearcut, 1 thinned, 3 reference) and New Brunswick (15 with 0 to 69% of the watershed planted). Nitrogen isotope data from Ontario indicate longer food webs in streams with burned and logged watersheds compared to reference streams (33 and 17% longer, respectively). Carbon isotope data indicate that shredders feed on leaves, but that scrapers are not feeding on biofilm as anticipated. Linking food web results to forest condition may be crucial to understanding factors driving differences in food web structure among headwater streams.

MODELING OF STREAM MACROINVERTEBRATE COMMUNITIES UNDER CLIMATE CHANGE

Mustonen, Kaisa-Riikka; Mykrä, Heikki; Sarremejane, Romain; Hawkins, Charles; Marttila, Hannu; Muotka, Timo

103AB
Monday, 18 May, 2015 13:45 - 14:00

At the northernmost latitudes, air temperature is predicted to increase steeply by the end of the century. Precipitation and snow-fall are also predicted to change with potentially significant effects on flow regimes. In boreal regions, cold-water species may be unable to escape the novel thermal regime, and their distributions may be strongly affected. We used site-specific modeled air temperatures and hydrological indices together with five different climatic scenarios based on medium emissions to predict the future (2020 to 2100) benthic macroinvertebrate community composition at 240 sites across Finland. We used RIVPACS-type multi-taxon niche modelling to predict the present-day composition of macroinvertebrate communities and to evaluate potential future changes. The final model included six variables: air temperature and five hydrological indices related to different aspects of flow regime. The mean observed-to-expected (O/E) ratios decreased steadily throughout the century under all climatic scenarios. Compositional changes in macroinvertebrate taxa were predicted to be most extreme in the northernmost sites. These results indicate that currently used biomonitoring programs will need to be modified to accommodate climate-change induced alteration of stream biodiversity.

ECOLOGY OF PLACE: CONTRIBUTIONS OF J. DAVID ALLAN TOWARD UNDERSTANDING THE ROLE OF PREDATION IN OPEN SYSTEMS

Peckarsky, Barbara

103C
Monday, 18 May, 2015 13:45 - 14:00

Studies of predation traditionally focus on how predator-induced mortality explains prey population oscillations and community composition. Studies initiated by Allan and continued by his disciples for over 40 years in high-elevation streams of western Colorado have enabled us to reevaluate the generality of those traditional views. While early observations fit the traditional model of negative correlation between predator and prey abundance, results of a ground-breaking whole-stream experiment showed that predation by salmonids did not explain variation in abundance of primary consumers (mayflies) or large invertebrate predators (stoneflies). Instead, this experiment demonstrated that high prey mobility can obscure potential effects of predation. Expanding Allan's natural history observations to many years of experiments in multiple streams forced traditional thinking to give way under a progression of evidence supporting the under-appreciated importance of non-consumptive effects of predators. This collective research motivated a new general conceptual model that in open systems with high levels of prey dispersal, the predominant influence of predators may result from adaptive changes in prey behaviors and life histories, rather than from predator-induced mortality.

SEDIMENT MICROBIAL COMMUNITY COMPOSITION AND BIOGEOCHEMISTRY ALONG VERTICAL GRADIENTS IN A HIGH SULFUR SUBMERGED SINKHOLE IN LAKE HURON, MI

Kinsman-Costello, Lauren; Sheik, Cody; Burton, Allen; Sheldon, Nathan; Dick, Gregory

102C
Monday, 18 May, 2015 13:45 - 14:00

Submerged groundwater seeps in Lake Huron establish ecosystems with distinctive geochemical conditions. In the low-O2, high-sulfur environment of the Middle Island Sinkhole (MIS), a 23-m deep seep, a metabolically flexible microbial mat capable of anoxygenic photosynthesis, oxygenic photosynthesis and chemosynthesis thrives. However, little is known about the structure and function of organic-rich sediments beneath the mat. Using parallel pore water and sediment geochemical characterization along with microbial community analysis, we elucidate relationships between microbial community structure and ecosystem function in a highly unique and environmentally vulnerable ecosystem along vertical gradients. Microbial community composition was distinctly different from non-groundwater affected areas at similar depth nearby in Lake Huron. MIS sediment communities changed with depth and were related to several geochemical variables, including organic matter, total sediment zinc, and multiple indicators of phosphorus availability, including pore water phosphate concentration, sediment total phosphorus, and sediment iron-to-phosphorus ratio. Despite the importance of high sulfur concentrations in the system, microbial community composition was unrelated to indicators of sulfur cycling, including pore water sulfate concentration and acid volatile sulfides.

ALKYL POLYGLUCOSIDE-CONTAINING COMPOUND ALTERS PLANKTON COMMUNITY COMPOSITION IN BLACKWATER POND MESOCOSMS

Riera, Steven; Cohen, Risa A.

102B
Monday, 18 May, 2015 13:45 - 14:00

Synthetic surfactants in detergents and cleaners commonly contaminate freshwater systems. Therefore developing low-toxicity alternatives, such as alkyl polyglucosides (APGs), is important. Although APGs degrade rapidly and reduce chemical exposure time, biodegradation consumes oxygen. Blackwater systems in the southeastern U.S. frequently experience low dissolved oxygen (DO) conditions, making them particularly sensitive to adverse effects from oxygen-demanding chemicals. We hypothesized that APG-containing products adversely affect plankton communities via direct toxicity to algae and zooplankton, as well as through reduced water quality and food availability to zooplankton. Floating mesocosms (440 L) were deployed in a blackwater pond in Georgia, USA and dosed with 0, 0.01, 2.5, 5, or 10 mg L-1 APG. DO concentration, phytoplankton abundance (as chlorophyll a), and zooplankton community composition were determined weekly for one month. Despite reductions in DO (4.4-12.4%) and chlorophyll a (24.6-81.1%) with increasing APG concentration, changes in the zooplankton community were likely due to APG toxicity. The decrease in zooplankton abundance was due to loss of copepods that shifted the community toward domination by cladocerans, suggesting differential sensitivity among zooplankton to APG under environmentally relevant conditions.

IN-STREAM NITROGEN PROCESSING AND DILUTION IN AN AGRICULTURAL STREAM NETWORK

Ward, Adam; Prior, Kara; Davis, Caroline; Burgin, Amy; Loecke, Terrance; Riveros-Iregui, Diego; Schnoebelen, Douglas; Just, Craig; Thomas, Steven; Weber, Larry; St. Clair, Martin; Spak, Scott; Dalrymple, Kajsa

101B
Monday, 18 May, 2015 13:45 - 14:00

The interaction of agricultural fertilizer use by humans and extremes in drought and flood conditions in 2012-2013 set up conditions for a natural experiment on watershed-scale nutrient dynamics. The region-wide drought in 2012 left surface soils disconnected from stream networks and restricted nutrient use by crops, resulting in an unusually large nitrogen pool in soil columns through the winter. When wet conditions returned to the Midwest in 2013, the unused fertilizer was mobilized, resulting in a six-week period of extremely high in-stream nutrient concentrations. This study analyses three synoptic samples from the Iowa-Cedar River Basin in 2013 to quantify patterns in nitrogen dynamics. We use multiple conservative ions as tracers to estimate dilution by lateral inflows. We also estimate nutrient spiraling metrics by treating the fertilizer pulse as a constant rate nutrient addition across the watershed—a scale on which these processes are increasingly modeled numerically, but on which standard nutrient addition experiments are not feasible. Results of this study compare patterns in dilution and uptake across spatial and temporal scales, and bound feasible explanations for each reach of the network.

MECHANISMS OF TOLERANCE AND DISTRIBUTION: COMPARING THE OXIDATIVE STRESS RESPONSE IN TWO INVASIVE DREISSENID MUSSELS UNDER DIFFERENT ENVIRONMENTAL STRESSORS

Nowicki, Carly; Kashian, Donna

101A
Monday, 18 May, 2015 13:45 - 14:00

The invasive bivalves Dreissena polymorpha and D. bugensis have similar ecological niches and are significant pest species in North America and Europe. Dreissena bugensis has exhibited competitive advantages over D. polymorpha and is displacing D. polymorpha as the dominant dreissenid species in the North American Great Lakes. To understand this displacement, differences in tolerance to environmental stressors between the two species requires further study. Oxidative stress (OS) is a mechanism in which organisms mitigate environmental stressors, and monitoring OS biomarkers is useful to compare tolerance in dreissenid mussels. Mussels were evaluated for OS via lipid peroxidation and catalase activity following exposure to four stressors (e.g., high densities, temperature, hypoxia, and polychlorinated biphenyls). Dreissena bugensis had a stronger OS response than D. polymorpha indicated by higher levels of antioxidants ($p < 0.05$) or lower levels of lipid peroxidation ($p < 0.05$) in all the “stressed” conditions. This research demonstrates a correlation between tolerance to environmental stressors and antioxidant response. Higher tolerance to stress resulting from a stronger OS response may provide D. bugensis a competitive advantage over D. polymorpha.

SPECIES OF SOUTHEASTERN USA MAYFLY, STONEFLY, AND CADDISFLY LARVAE

Morse, John C.; Stark, Bill P.; Jacobus, Luke M.

101CD
Monday, 18 May, 2015 13:45 - 14:00

The long-awaited update of species-level keys for southeastern US Ephemeroptera, Plecoptera, and Trichoptera (EPT) is nearing completion. Species diversity of mayflies, stoneflies, and caddisflies in this region is high, with at least 310 species of mayflies, 291 species of stoneflies, and 663 species of caddisflies known or likely to occur in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee). Southeastern larvae of 298 mayfly species (96%), 161 stonefly species (55%), and 307 caddisfly species (46%) are sufficiently known to permit at least tentative identification with diagnostic keys. Keys for southeastern EPT species of larvae in several genera are provided for the first time. Benthologists studying faunas in nearby states also will likely find these keys useful. The work will be available from Clemson University Public Service Publishing http://www.clemson.edu/psapublishing/ .

ASSEMBLAGE CHANGE IN A LARGE RIVER ECOSYSTEM: HISTORICAL AND RECENT FOOD-WEB COMPARISONS

Pyron, Mark; Becker, Jesse; Wyatt, Kevin; DeColibus, Dawn; Etchison, Luke; Minder, Mario; Murry, Brent; Broadway, Kyle; Logsdon, Rebecca; Chaubey, Indrajeet

103DE
Monday, 18 May, 2015 13:45 - 14:00

We identified a community shift in the fish assemblage of the Wabash River using a long-term dataset of electrofishing data from 1974-2008. The fish assemblage changed in approximately 1992 from a planktivore-omnivore dominated community to benthic invertivore dominated. A concurrent study on agricultural nutrient contributions to the river during the same time period indicated significant negative correlations of organic nitrogen with benthic invertivore fish relative abundance (and postitive correlations with phosphorus inputs). We sampled stomachs of planktivores from archival collections, as a representation of historical phytoplankton in the river. Our analyses showed phytoplankton communities of the 1960s that were dominated by green algae, a relatively high quality food source to fishes. The current community is dominated by blue-greens and diatoms that have less nutritional quality to fishes. The carbon and nitrogen isotope ratios of consumers were used to reconstruct historical food webs for comparison to recent food webs, using fishes and mussel specimens from recent and archival natural history collections. C and N isotope ratios in historical food webs were different from recent food webs.

FOOD WEB COMPLEXITY STABILIZES SEASONAL VARIABILITY IN RIVER–TERRESTRIAL LINKAGES

Terui, Akira; Akasaka, Takumi; Negishi, Junjiro; Uemura, Fumihiko; Nakamura, Futoshi

102DE
Monday, 18 May, 2015 14:00 - 14:15

Aquatic–terrestrial trophic linkages play a role in transporting materials from rivers to adjacent ecosystems. Although the trophic links have often been conceived as static and depicted as a single pathway, there are a variety of links containing seasonal variations. We investigated how donor prey (aquatic insects) and recipient consumer diversity (ground beetles) interact to stabilize seasonal variability of the material flow from rivers to adjacent gravel bars. Surveys were conducted in the Tottabetsu River, Hokkaido, Japan. Based on CN isotopic information and biomass of each consumer species, we estimated how material flow through aquatic insect–ground beetle links has changed over time (June to October). The seasonal variability of material flow mediated by individual trophic links (measured as CV) was high, and each had its own seasonal peak. However, they changed in a compensatory way and greatly stabilized the summed material flow at the community level. This suggests the importance of temporarily-resolved perspective on food webs.

HISTORICAL CHANGES IN FOOD WEB STRUCTURE OF THE MISSISSIPPI AND OHIO RIVERS IN RESPONSE TO DAMMING

Bowes, Rachel; Thorp, James; Delong, Michael

103DE
Monday, 18 May, 2015 14:00 - 14:15

Damming is the single most important factor influencing river connectivity and its ecological functions. How do food webs respond to massive structural changes to river systems? The Mississippi and Ohio rivers have perhaps the best historical samples in the USA, and provided a unique opportunity to look at food web drivers over long time scales. Trophic position was evaluated using amino acid compound specific stable isotope analysis of fish museum specimens. We found a shift in trophic positions in the Mississippi River in response to the major damming events. Discharge, gage height, and temperature were not correlated with the shift in trophic position. The physical presence of the dams altered the complexity of the system, altering food web structure. The Ohio River did not show this same change in food web structure with the addition of the dams. This probably reflects the minimal change in complexity in the Ohio River with construction of the dams. The dams operate differently in the two river systems, and when habitat structure is altered from a dam, the food web is fundamentally changed.

LONG-TERM (1978–2012) PATTERNS OF INSECT COMMUNITIES IN AN ARCTIC RIVER

Kendrick, Michael; Hershey, Anne; Huryn, Alexander D

103AB
Monday, 18 May, 2015 14:00 - 14:15

In response to rapidly rising temperatures due to the polar amplification of greenhouse warming, river ecosystems in the Arctic are expected to undergo significant change during this century. To provide insight into the potential consequences of these changes to aquatic communities, we assessed temporal patterns of insect life histories in the Kuparuk River in arctic Alaska. Sampling during the 2011 open-water season revealed the presence of a previously undocumented spring cohort for Cinygmula (Ephemeroptera). A selection of growth rates for the grazing mayfly Acentrella lapponica from 1986-2012 reveals no consistent change through time. Analysis of growth rate and abundance for A. lapponica collected in 2001, 2009-2012 show a strong correlation with epilithic nitrogen:phosphorus ($r2>0.65$). Abundance for Orthocladius rivulorum (Chironomidae) was strongly correlated with algal biomass over a 29-year period ($r2=0.39$). These data demonstrate that resource quality and/or quantity appear to be important factors for the dominant grazers in the Kuparuk River. This further emphasizes the importance of shoulder seasons to aquatic insect communities and suggests that factors other than temperature may be important components of community responses to climate change.

ARE QUAGGA MUSSELS SENSITIVE TO MICROCYSTIS AERUGINOSA BLOOMS? A COMPARISON WITH SENSITIVE DAPHNIA PULEX

Boegehold, Anna; Kashian, Donna; Alame, Karim; Johnson, Nicholas

101A
Monday, 18 May, 2015 14:00 - 14:15

Invasive dreissenid mussels inhabit waters that experience toxic cyanobacteria blooms of Microcystis aeruginosa. While these blooms might not cause widespread mortality, Microcystis may still impact dreissenids. We compared non-lethal endpoints of Microcystis exposure in quagga mussels, Dreissena rostriformis bugensis, to Daphnia pulex, a sensitive zooplankton routinely used in toxicity testing. Oxygen consumption, filtration rate, and two oxidative stress biomarkers were tested in mussels, and standard measurements of growth and fecundity were evaluated in Daphnia. Treatments included two strains of Microcystis (lab cultured and collected from Lake Erie), and the isolated toxin microcystin-LR (100 and 400 ug/L). Microcystis had no effect on oxygen consumption in Dreissena, but it decreased filtration rate ($p<0.05$). Oxidative stress response in mussels was elevated in the presence of microcystin-LR ($p<0.05$). Both Microcystis strains and microcystin-LR (400 ug/L) negatively affected Daphnia adult size ($p<0.05$). Only the Lake Erie Microcystis reduced fecundity in Daphnia ($p>0.01$). While Microcystis negatively impacted both species, Dreissena was more responsive to lower concentrations of microcystin-LR, suggesting that Dreissena populations may be particularly sensitive during bloom events where control measures may prove more effective.

DAVE ALLAN'S LEGACY AND THE EMERGENCE OF EXPERIMENTAL STREAM ECOLOGY: UNDERSTANDING THE FUNCTIONAL ROLE OF FISHES IN RUNNING WATER ECOSYSTEMS

Flecker, Alexander

103C
Monday, 18 May, 2015 14:00 - 14:15

Over the last forty years our understanding of the role of biotic interactions in streams has progressed dramatically. Moreover, the toolbox employed by stream ecologists has developed whereby running water ecosystems provide some of the best examples of ecological concepts in real world settings. I will begin by describing the significance of Dave Allan's foundational studies on fishes in stream ecosystems, and his pioneering contributions towards the emergence of experimental stream ecology. I will then provide examples of where we stand today in our understanding of fish as strong drivers of stream ecosystem structure and function. Stream ecology has transitioned from a largely observational field that overlooked the significance of biotic interactions to a highly experimental, hypothesis-based science where interactions play a central role. Building on this foundation, the importance of fish and other organisms as major organizing forces is now firmly established.

SIMULATING CONCURRENT METABOLIC PATHWAYS IN BIOGEOCHEMICAL SYSTEMS

Reinhold, Ann Marie; Poole, Geoffrey; Helton, Ashley M. ; Payn, Robert; Izurieta, Clemente; Bernhardt, Emily; Burgin, Amy

102C
Monday, 18 May, 2015 14:00 - 14:15

The behavior of biogeochemical systems is dictated by interactions amongst multiple elemental cycles, yet elemental cycles are easier to conceptualize in isolation than in concert. To assist thinking in terms of biogeochemical systems rather than individual cycles, we developed a thermodynamically-based model that simulates the co-occurrence of competing metabolic pathways based on (1) the availability of electron donors and acceptors required by each pathway, (2) the energetic yield of each pathway, (3) the energetic demand of microorganisms, and (4) microbial growth constraints imposed by ecological stoichiometry. We performed a model sensitivity analysis by systematically varying the availability of DOC, oxygen, nitrate, sulfate, and methane in the model, and analyzed results with multivariate statistics to identify broad drivers of biogeochemical systems. Our results identify several hypotheses describing broad drivers of biogeochemical system behaviors, such as the implications of competition for electron donors versus acceptors and variation in the ratio of metabolic demand for energy versus free energy yield from potential metabolic pathways.

REDISCOVERY OF ZAPADA CHILA IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK AND A REVIEW OF THE EASTERN MEMBERS OF THE GENUS

Grubbs, Scott; Baumann, Richard; Sheldon, Andrew

101CD
Monday, 18 May, 2015 14:00 - 14:15

The eastern Nearctic Zapada (Plecoptera, Nemouridae) fauna is reviewed and a new species is described from the southern Appalachian Mountains. During 2014 the rare species Z. chila (Ricker) was collected for the 1st time in 35 years. The new species, Zapada sp. n., appears closely related to Z. cinctipes (Banks), a broadly-distributed western Nearctic species. Easily-recognized differences in gill and male vesicle structure of the adults of Z. chila, Zapada sp. n., and Z. katahdin Baumann and Mingo distinguish the three eastern species. Unlike western Zapada, most of which are widely distributed and common, eastern Zapada are uncommon or have restricted ranges at high elevations. Zapada chila is still known only from the type locality on the Tennessee side of Great Smoky Mountains National Park and Zapada sp. n. appears restricted to the southern Appalachian Highlands in North Carolina, Tennessee, and Virginia. Zapada katahdin has the broadest distribution from New Hampshire northward to Labrador and Nova Scotia. Zapada chila and Zapada sp. n. appear vulnerable to extinction in light of altitudinal range reduction and climate warming issues.

IN-STREAM NITROGEN PROCESSING AND DILUTION IN AN AGRICULTURAL STREAM NETWORK

Ward, Adam; Prior, Kara; Davis, Caroline; Burgin, Amy; Loecke, Terrance; Riveros-Iregui, Diego; Schnoebelen, Douglas; Just, Craig; Thomas, Steven; Weber, Larry; St. Clair, Martin; Spak, Scott; Dalrymple, Kajsa

101B
Monday, 18 May, 2015 14:00 - 14:15

The interaction of agricultural fertilizer use by humans and extremes in drought and flood conditions in 2012-2013 set up conditions for a natural experiment on watershed-scale nutrient dynamics. The region-wide drought in 2012 left surface soils disconnected from stream networks and restricted nutrient use by crops, resulting in an unusually large nitrogen pool in soil columns through the winter. When wet conditions returned to the Midwest in 2013, the unused fertilizer was mobilized, resulting in a six-week period of extremely high in-stream nutrient concentrations. This study analyses three synoptic samples from the Iowa-Cedar River Basin in 2013 to quantify patterns in nitrogen dynamics. We use multiple conservative ions as tracers to estimate dilution by lateral inflows. We also estimate nutrient spiraling metrics by treating the fertilizer pulse as a constant rate nutrient addition across the watershed—a scale on which these processes are increasingly modeled numerically, but on which standard nutrient addition experiments are not feasible. Results of this study compare patterns in dilution and uptake across spatial and temporal scales, and bound feasible explanations for each reach of the network.

EFFECTS OF ROTENONE CONCENTRATIONS ON ZOOPLANKTON AND BENTHIC MACROINVERTEBRATES IN ALPINE LAKES AND STREAMS

Courtwright, Jennifer; Miller, Scott; Plunkett, Chris

102B
Monday, 18 May, 2015 14:00 - 14:15

The piscicide rotenone is ubiquitously used in the restoration of native trout. However, studies of the impacts to non-target organisms have largely produced inconclusive results because of poor study design, failure to measure rotenone concentrations, and possible differential responses across taxa and habitats. We implemented a before-after-control-impact study design to quantify the effects of rotenone on non-target organisms in an alpine environment. We assessed the effects of rotenone on zooplankton in five lakes and benthic macroinvertebrates in six streams one week pre-treatment and one week, one month, and one year post-treatment for two years of rotenone treatments. Reponses of zooplankton and benthic macroinvertebrates differed among years, sites, and community metrics, with responses ranging from no response to 50% reductions in richness and 90% reductions in density persisting for at least one month post-treatment. Differences in rotenone concentrations and persistence explained up to 76% of the variability in richness but <15% of the variability in densities for both zooplankton and macroinvertebrates. Future research should further examine physical habitat influences on rotenone persistence and differential life history responses to rotenone treatments.

INVESTIGATION OF FRESHWATER MUSSEL GLOCHIDIA PRESENCE ON ASIAN CARP AND NATIVE FISHES OF THE ILLINOIS RIVER

Douglass, Sarah; Stodola, Alison; Fritts, Andrea

103DE
Monday, 18 May, 2015 14:15 - 14:30

Asian carp have been reported to serve as fish hosts to freshwater mussels in their native territories, but no one has conducted research on the potential for Silver, Bighead, or Black Carp to host North American freshwater mussels or if they serve as reproductive sinks. Native fishes and non-native carp species were collected from the Illinois River Basin during summer of 2014. Preserved fins, tail, and gills of native and non-natives were observed, of which gills were first soaked with a 5% potassium hydroxide solution for 20 minutes to increase transparency. Our primary objective was to evaluate the potential presence of glochidia on non-native fishes in the Illinois River system; if found, this would be the first documented record for Silver and Bighead Carp in North America and would provide great incentive to pursue further studies to elucidate if Asian carp could serve as a successful host fish for native mussels or if they are serving as reproductive sinks, a possibility that could have a major impact on the future stocks of currently imperiled freshwater mussels.

COMBINED EFFECTS OF HYPORHEIC METABOLISM & POREWATER FLOW ON REACH-SCALE NUTRIENT UPTAKE: DO CONSERVATIVE TRACERS CAPTURE DISTRIBUTIONS OF HYPORHEIC METABOLISM?

Packman, Aaron; Li, Angang; Aubeneau, Antoine

101B
Monday, 18 May, 2015 14:15 - 14:30

Co-injections of conservative tracers and nutrients are commonly used to assess net reach-scale nutrient transformation rates and benthic/hyporheic uptake parameters. However, little information is available on spatial patterns of metabolism in the benthic and hyporheic regions. We used numerical simulations to explore the effects of localized metabolism on estimates of reach-scale nutrient uptake rates. Metabolism locally depletes nutrient concentrations relative to conservative tracers, causing their concentration profiles of injected nutrients and conservative tracers to diverge. At slow rates of hyporheic exchange relative to rates of metabolism, overall hyporheic nutrient uptake is limited by delivery from the stream, and effective reach-scale nutrient uptake parameters will be controlled by the hyporheic exchange rate. At high rates of hyporheic exchange, the injected tracer can propagate beyond regions of high microbial activity, which commonly occur near the streambed surface. In this case, the injected tracer may not adequately capture timescales of nutrient replenishment in the most bioactive regions (periphyton, biofilms). We will show how both processes alter the relationship between local- and reach-scale biogeochemical transformation rates.

THE IMPORTANCE OF TERRESTRIAL SUBSIDIES IN STREAM FOOD WEBS VARIES ALONG A STREAM SIZE GRADIENT

Collins, Sarah M; Kohler, Tyler; Thomas, Steven; Fetzer, William; Flecker, Alexander

102DE
Monday, 18 May, 2015 14:15 - 14:30

Energy and material subsidies can comprise a substantial fraction of food web fluxes in some ecosystems, especially when primary production is strongly limited. We explored whether assimilation of terrestrial energy varied within consumers collected from streams of different sizes and resource availabilities. Since headwater streams are often unproductive, we expected that inputs from surrounding terrestrial systems would be an important food source for consumers, while mid-size rivers would have more open canopies and higher amounts of primary production available for consumers. We collected basal resources, invertebrates, and fish along stream size gradients in both tropical and temperate sites and analyzed each sample for hydrogen stable isotopes (a proxy for material derived from allochthonous sources). Allochthonous energy use was positively correlated with canopy cover in both regions, with consumers from small, shaded streams having a more allochthonous signal than individuals collected from larger streams with open canopies. Our results demonstrate that the importance of terrestrial subsidies can vary markedly, with some taxa that range from being entirely allochthonous to entirely autochthonous, and others that are relatively fixed in their energy source.

SALT IN OUR STREAMS: EVEN SMALL SODIUM ADDITIONS HAVE NEGATIVE EFFECTS ON DETRITIVORES

Tyree, Meredith; Clay, Natalie; Entrekin, Sally

102B
Monday, 18 May, 2015 14:15 - 14:30

Freshwater ecosystems are threatened by rising ion concentrations from agriculture, urbanization and resource extraction. Large, pulsed NaCl additions can increase the mortality of aquatic biota like detritivores, but the effects of chronic low-level additions are less understood. Small ionic increases may alleviate sodium limitation or osmoregulatory stress, thereby increasing microbial respiration and macroinvertebrate consumption, growth, and assimilation efficiency. We tested these predictions in freshwater microcosms containing either just sweetgum leaves with associated microbes or leaves, microbes, and an isopod (Lirceus sp.). Microcosms had one of three NaCl treatments: low (3mgL-1Na; ambient), medium (14mgL-1Na), or high (140mgL-1Na). After 6 weeks, microbial respiration averaged 15% lower in medium and 29% lower in high than low treatments. Lirceus ate 71% more leaves in high than medium treatments, and assimilation efficiency was similar among treatments, averaging 75%. However, Lirceus growth was consistent between medium and high treatments. These results suggest Lirceus respiration increased from osmoregulatory stress in high NaCl treatments. Reduced growth from chronic low-level NaCl additions could lower detritivore fecundity and inhibit emergence, thereby altering stream community structure and function and reducing decomposition.

ASSESSING AQUATIC INVERTEBRATES ALONG ELEVATION GRADIENTS IN GRAND TETON NATIONAL PARK, WYOMING

Tronstad, Lusha; Hotaling, Scott; Bish, Cody

103AB
Monday, 18 May, 2015 14:15 - 14:30

High elevation ecosystems are predicted to be strongly impacted by climate change; however, little is known of the extant biodiversity in mountain streams and lakes. We sampled 5 streams and 6 lakes in Grand Teton National Park, Wyoming to establish a baseline of invertebrate assemblages and environmental conditions. We collected 5 surber samples from low, middle and high elevation sites along each stream. We collected nearly 10,000 individuals per meter square from streams, but the density (ANOVA, p=0.18) and richness (p=0.54) of invertebrates did not vary significantly by elevation. Invertebrate assemblages were more similar at low sites compared to high sites when plotted using non-metric multidimensional scaling. Total density of invertebrates was positively related to the amount of visible biofilm (AIC,p=0.03) and oxidation-reduction potential (p=0.05), and taxa richness was negatively related to specific conductivity (p=0.009). Littoral invertebrates were far less diverse in lakes (19 taxa) compared to streams (68 taxa). Our data may help target aquatic invertebrates to monitor as temperatures rise, and the biotic and abiotic factors that structure alpine aquatic ecosystems in Grand Teton National Park.

EVIDENCE FOR RAPID MORPHOLOGICAL EVOLUTION IN A SMALL CLADE OF RHYACOPHILA SPECIES IN THE EASTERN USA

Robinson, Jason

101CD
Monday, 18 May, 2015 14:15 - 14:30

Speciation and other macroevolutionary processes, as well as local ecological interactions, are responsible for generating patterns of species distributions in space. Although there are many mechanisms at work in this domain, dispersal and colonization dynamics have long remained among the most useful explanatory models in biogeography. With the advent of null model analyses of species distributions, we know we may have only very limited certainty around any inferences of process from these patterns. Nevertheless, faunal breaks and phyletic patterns or "tracks" remain consistent themes in our theories to explain regional distributions of aquatic insect fauna. I present a case study where many lines of evidence support inferences on the mechanisms of speciation, andpatterns of species and phylogeographic distributions (referencing a limited dataset of a 658 base pair mitochondrial markers) across the eastern US. I discuss several possible interpretations of the trajectory of evolution of these morphological characters in this species group and speculate on how lock-and-key conceptual models of speciation and the evolution of reinforcement of reproductive isolation should guide species delimitation and biogeographical studies.

THE NATURAL FLOW REGIME: PAST, PRESENT AND FUTURE

Poff, LeRoy

103C
Monday, 18 May, 2015 14:15 - 14:30

The “natural flow regime” concept has played an important role in advancing aquatic conservation in the last 20 years. It was conceived as a synthesis of basic ecological understanding that could be translated into management action, and JD Allan played a very significant role in its formulation. The science and practice of “environmental flows,” which aims to mitigate undesirable impacts of dams and diversions has been greatly informed by natural flow regime thinking. But the practice of e-flows is based assumptions that are undercut by rapid climate change and other forms of non-stationarity. Major challenges facing the continued acceptance and application of e-flows include the need to move from a static representation of hydrologic variation to a more dynamic framing where shifting baselines and multiple ecological endpoints are embraced in order to transition from a restoration to an adaptation perspective. Natural flows thinking can guide management actions to guide conservation in a non-stationary and uncertain future, even in highly altered systems where valued ecosystem functions are threatened by further hydrologic alteration.

DIET PREFERENCES OF ROUND GOBY (NEOGOBIUS MELANOSTOMUS) NEAR SLEEPING BEAR DUNES NATIONAL LAKESHORE

Johnson, Erica; Tucker, Taaja ; Farha, Steven ; Wigren, Paige; Riley, Stephen

101A
Monday, 18 May, 2015 14:15 - 14:30

The invasive round goby (Neogobius melanostomous)has been hypothesized as a possible vector for Type-E botulism along with the nuisance alga Cladophora glomerata. The objective of this study was to identify interannual patterns in goby diets in areas with and without Cladophora. Samples were collected in Lake Michigan near Sleeping Bear Dunes National Lakeshore from 2012-2013. A total of 745 fish were captured using minnow traps, categorized into three size classes (<59mm; 60-99mm; >100mm), and processed for stomach content analysis. Microcrustacea (copepods, cladocerans, and ostracods) were important diet items for all size classes, comprising 43-90% of total gut contents. There was a trend towards higher taxonomic richness in all size classes in 2012 than in 2013. Schoener's index revealed that there was high diet overlap (R0>0.77) between fish living in both habitat types. Preliminary results suggest that presence of Cladophora mats may not play a major role in goby feeding preferences.

HYDROLOGIC CONTROLS ON BIOGEOCHEMICAL GRADIENTS IN THICK LAYERS OF FLOCCULENT ORGANIC SEDIMENTS IN A THROUGH-FLOW WETLAND

Kincaid, Dustin; Briggs, Martin; Hamilton, Stephen K.; Zarnetske, Jay

102C
Monday, 18 May, 2015 14:15 - 14:30

Thick accumulations of flocculent organic sediment, or floc, are nearly ubiquitous in shallow freshwater ecosystems lacking strong physical disturbance regimes. Despite the prevalence of these sediments in a diversity of shallow water bodies, there is little information on their biogeochemical and ecological importance. Importantly, floc forms a transitional zone that is more connected to overlying water than relatively consolidated sediments, and is subject to dynamic variation in reduction-oxidation (redox) status. In Fall 2014, we monitored heat-exchange processes across the floc-water interface using vertical fiber-optic high-resolution distributed temperature sensors (HRTS) to reveal the timing and modes of hydrologic exchange (i.e., conduction vs. advection dominated) in thick floc layers (e.g. up to 1 m) of a through-flow wetland. The profiles revealed discrete zones of floc influenced by groundwater upwelling that limited vertical heat and solute exchange from surface waters, while other profiles showed deeper exchange patterns. The vertical porewater chemical profiles collected adjacent to each HRTS showed diel changes in redox sensitive solutes along the shallow profiles. This presentation explores how dominant hydrologic exchange processes influence biogeochemical gradients in floc.

COMBINED EFFECTS OF HYPORHEIC METABOLISM & POREWATER FLOW ON REACH-SCALE NUTRIENT UPTAKE: DO CONSERVATIVE TRACERS CAPTURE DISTRIBUTIONS OF HYPORHEIC METABOLISM?

Packman, Aaron; Li, Angang; Aubeneau, Antoine

101B
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DEVELOPING A REGIONAL TO CONTINENTAL SCALE MODEL OF DISSOLVED ORGANIC CARBON FLUX AND PROCESSING IN RIVER NETWORKS

Mineau, Madeleine; Wollheim, Wil; Stewart, Robert; Hunt, Christopher; Kicklighter, David

102C
Monday, 18 May, 2015 14:30 - 14:45

Dissolved organic carbon (DOC) is an important energy source influencing stream ecosystem function and also has implications for drinking water supply. Though there are currently several models of catchment scale DOC dynamics, there is no model simulating DOC dynamics in river networks at the regional to continental scale. We have developed such a model for the northeastern US, using the Framework for Aquatic Modeling in the Earth System (FrAMES), a process based and spatially distributed hydrology and biogeochemistry model. We compared model performance predicting DOC inputs to the river system using empirical loading relationships based on wetlands or soil type with runoff and utilizing output from an existing terrestrial ecosystem model (TEM). We applied DOC removal rates based on a literature review of reach scale DOC uptake measurements. Applying uptake velocities from reach-scale additions of simple compounds or leachates resulted in an apparent overestimation of processing rates and underestimation of DOC concentrations. Advancement of river network DOC models will necessitate empirical research to provide additional information regarding in-situ processing rates of ambient DOC and mechanisms controlling DOC loading to streams.

HAS THE BENTHIC MACROINVERTEBRATE COMMUNITY OF SOUTHWESTERN LAKE ONTARIO CHANGED SINCE THE ROUND GOBY INVASION?-1983 TO 2014

Bailey, Katherine; Haynes, James

101A
Monday, 18 May, 2015 14:30 - 14:45

In Lake Ontario, the establishment of dreissenid mussels (Dreissena spp.) in the late 1980s, the amphipod Echinogammarus ischnus in the mid-1990s, and the round goby (Neogobius melanostomus) in the mid-2000s has engendered mixed responses, long- and short-term, in benthic macroinvertebrate communities. We sampled and quantified benthic macroinvertebrate abundances at a natural cobble site and artificial reef located in southwestern Lake Ontario near Olcott, New York, where benthic macroinvertebrate abundances were documented in 1983, 1991-1992, and 1999-2000. We found a significant difference in benthic community composition among year groups (Analysis of Similarities, $R = 0.854$, $p = 0.01$). We observed a shift in dominant taxa at both study sites, as oligochaetes and chironomids increased by more than 50% from 2000 to 2014, gastropods decreased by >50%, and E. ischnus became the dominant amphipod for the first time in 2014. Our findings suggest that the combined presence of round gobies and dreissenids has shifted the macroinvertebrate community structure from one dominated by gastropods and crustaceans, particularly the amphipod, E. ischnus, to one dominated by small, soft-bodied taxa (e.g, oligochaetes and chironomids).

FLUXES OF CARBON AND NITROGEN FROM ISOTOPICALLY-ENRICHED LEAF LITTER TO A SHREDDING CADDISFLY REVEAL DIFFERENCES IN LITTER QUALITY

Siders, Adam; Compson, Zacchaeus; Marks, Jane

102DE
Monday, 18 May, 2015 14:30 - 14:45

Leaf litter is a crucial energy base for most headwater food webs. Although leaf litter from different trees varies in multiple chemical and physical traits, it is difficult to determine how these differences affect assimilation of carbon and nitrogen from leaves to aquatic macroinvertebrates. Rates of leaf decomposition are sometimes viewed as a proxy for food quality, with fast-decomposing litter thought to provide more nutrients to decomposers. We tested this hypothesis by comparing assimilation rates using leaf litter from four riparian tree species enriched with heavy carbon and nitrogen isotopes. Enriched leaf litter was incubated in a headwater stream in bags containing a shredding caddisfly Hesperophylax designatus. Three patterns emerged: (1) caddisflies assimilated carbon at the highest rates from slow-decomposing leaf litter. (2) Caddisflies assimilated nitrogen at the highest rates from fast-decomposing leaf litter. (3) The C:N ratio of assimilate was lowest for fast-decomposing leaf litter. These results demonstrate that nutrient fluxes vary by litter species, with fast-decomposing litter supporting higher nitrogen assimilation rates.

EPT TAXA OF UPPER GREAT LAKES NATIONAL PARK UNITS

DeWalt, R Edward

101CD
Monday, 18 May, 2015 14:30 - 14:45

National Parks are designed to protect the flora and fauna contained within them, but how are they doing? Intensive sampling of several upper Great Lakes National Park units will answer this question. The regional species pool will be defined for each park in two ways: regional presettlement distribution models for 427 EPT species for USGS HUC12 watersheds and through use of a >200,000 specimen record database developed over the past several years. Parks that have been sampled include: Indiana Dunes NLS, Sleeping Bear Dunes NLS, Isle Royale NP, and Voyageurs NP. The project is ongoing and additional sampling will take place in the listed parks and in St. Croix NSR and Pictured Rocks NLS. No sampling has occurred within the Apostle Islands NLS, but permits have been requested. This work will provide the first comprehensive inventories of mayflies, stoneflies, and caddisflies in upper Great Lakes National Park units and will allow the National Parks to know how well they are doing protecting the most sensitive of aquatic insects known for the region.

ANALYSIS OF LONG TERM PRIMARY PRODUCTION DATA IN KENTUCKY LAKE: CAN WE DETECT INVASIVE ASIAN CARP?

Tumolo, Ben; Flinn, Michael

103DE
Monday, 18 May, 2015 14:30 - 14:45

Silver Carp (Hypopthalmicthys molitrix) have established populations throughout the Midwestern U.S and populations in Kentucky Lake have increased rapidly within the past decade. This project aims to understand potential impacts of Silver Carp on reservoir primary productivity by utilizing multivariate long term data analysis. Kentucky Lake primary production was analyzed both temporally and spatially with nonmetric multi-dimensional scaling (NMDS). Primary production was compared pre (1990-2004) and post invasion (2005-2013). Spatial analysis of primary production compared contrasting reservoir habitats (e.g embayment and main channel). To date, overall NMDS results show overlap between primary production pre-and-post invasion along with high intrasite variability, making it difficult to detect changes. However, some patterns show important differences in primary productivity post invasion and are being analyzed further. Whether the recent invasion of Silver Carp is negatively impacting Kentucky Lake is not yet clear. Future analysis will focus on developing year by year rankings based on limnological parameters to account for intrasite variability. Understanding long term trends in the Kentucky Lake ecosystem is important to understanding the invasion ecology of Silver Carp.

SERVICE BEYOND THE UNIVERSITY: DAVID ALLAN'S MANY CONTRIBUTIONS TO THE WORK OF THE NATURE CONSERVANCY

Khoury, Mary

103C
Monday, 18 May, 2015 14:30 - 14:45

Thanks to David Allan's participation as a science advisor to the Michigan Chapter of The Nature Conservancy in the mid 90's, I learned of a job opportunity for an aquatic ecologist with The Nature Conservancy's Great Lakes Program. Almost twenty-years later, I am still with the Conservancy, and have had the privilege of benefitting from his many contributions to the organization, in his role as science advisor, as a board member and through his research. This talk will highlight those contributions and how they reflect and forwarded the evolution of the Conservancy's work on freshwater. In the mid-1990's, the Conservancy shifted to see its work in the context of ecoregions just as David shifted his work to use spatial data to tease out the relationship between land cover and land use on the ecology of rivers. As we have brought a broader view of ecological context to our work, David has been right there with advice, tools and data to support new scales of planning and action.

QUANTIFICATION OF MICROCYSTIN AMONG VARIOUS FISH SPECIES ACROSS MICHIGAN: A STUDY FOCUSED ON SAFE FISH CONSUMPTION

Snyder, Heather; Woller-Skar, Megan; Boyer, Gregory

102B
Monday, 18 May, 2015 14:30 - 14:45

The frequency and intensity of cyanobacterial blooms are increasing, resulting in an increase in cyanotoxins such as microcystin (Huisman et al., 2005). Microcystin is harmful if ingested and increasing levels of the toxin are a cause for concern from a human health perspective (Ibelings and Chorus, 2007). Microcystin exposure through water consumption is closely monitored in areas of concern; however, consumption of microcystin through fish is not generally regulated. A total of 141 fish of varying species were collected by the Department of Environmental Quality from four different lake basins in Michigan. Fish muscle tissue was tested for microcystin using Enzyme Linked Immunosorbent Assay. A subset of samples were additionally run using liquid chromatography mass spectrometry. Microcystin concentrations ranged from less than 2625 pg/g to 21814.82 pg/g dry weight, varying both between species and across locations. Detectable levels of microcystin were found at all locations. Channel catfish (Ictalurus punctatus), northern pike (Esox Lucius), and common carp (Cyprinus carpio) were found to have the highest concentrations of microcystin. These results highlight the need for regular monitoring of fish across Michigan.

POTENTIAL IMPACTS OF CLIMATE CHANGE ON REPRODUCTION AND DISPERSAL OF NATIVE ATYOIDA BISULCATA SHRIMP IN HAWAIIAN HEADWATER STREAMS

Yak, Charlie; Tingley, Ralph; Apwong, Maybeleen ; Akau, James; Foulk, Patra ; MacKenzie, Richard

103AB
Monday, 18 May, 2015 14:30 - 14:45

Tropical streams are dominated by amphidromous shrimp, fish, and snails that require perennial flow from streams to nearshore environments to complete their lifecycles. Stream flow is also an important environmental cue for the hatching and dispersal of amphidromous larvae as well as the recruitment of postlarvae. Stream flow alterations from dams, diversions and anticipated rainfall declines from climate change threaten species persistence and overall stream function. Utilizing a model ecosystem on the North Hilo coast of Hawaii Island that spans a 4,500 mm/year rainfall gradient, while land use and other physical variables were held constant, we examined how decreased stream flow impacted larval dispersal of the endemic atyid shrimp, Atyoida bisulcata. In 2013 and 2014, average egg counts and development stage in gravid female shrimp were compared across nine streams with differing flows. Relative differences in larval dispersal across streams were examined using 24-hour drift samples. Preliminary results from 2013 revealed that egg counts were strongly, but not significantly correlated ($r = 0.74$; $p=0.06$) with stormflow (Q10). Results comparing egg counts and larval drift among streams will also be presented.

SIZE MATTERS: THE EFFECT OF SUBSTRATE PARTICLE SIZE ON BENTHIC AMMONIUM AND PHOSPHATE UPTAKE RATES IN HIGH LATITUDE STREAMS

Parker, Samuel P.; Bowden, William; Arndt, Kyle A.; Benes, Joshua P.; Jent, Derrick G.; Giles, Courtney D.; Flinn, Michael

101B
Monday, 18 May, 2015 14:45 - 15:00

Aquatic reaction rates, such as ammonium and phosphate uptake, are commonly scaled to a projected area, which normalizes observations relative to a square meter of stream bottom. However, streambeds are not planar surfaces and the total surface area available for interactions is much greater than the projected area, depending on the size, distribution, and depth of sediments. We compared projected and total surface area normalized uptake rates of four homogeneous substrate treatment classes sorted from native river sediments (D50 particle size = 13, 31, 51, 84mm). Equal volumes of each treatment were colonized for five weeks in riffle and run habitats and collected for analysis in temperature controlled recirculating chambers (n=46). As anticipated, nitrogen and phosphorus uptake rates normalized using projected area decreased as sediment size increased. In contrast, uptake rates that were normalized using total substrate area were lower and tended to increase with increasing particle size. The significant interactions observed between substrate size and uptake has implications for predicting reaction rates in streams, especially in systems where substrate size is typically a function of location in the network.

ECOSYSTEM RESPONSES TO ASIAN CARP INVASION AND CONTROL: PATTERNS OF RIVERINE ZOOPLANKTON ABUNDANCE, BIOMASS, AND COMPOSITION

Casper, Andrew; Hinz, Collin J.; Pendleton, Richard M.

103DE
Monday, 18 May, 2015 14:45 - 15:00

Asian carp exert a strong indirect pressure on ecosystems through the planktivory. This talk summarizes projects that examine river zooplankton response to the arrival and removal of Asian carp over a 20 year period in the Illinois River. Plankton responses examined include; shifts in community composition since pre-Asian carp conditions, longitudinal patterns of plankton composition across a 250 kilometers gradient of Asian carp abundance, and an assessment of the potential for rapid recovery of the zooplankton to localized carp removals of between 2 -20 tones from a single floodplain backwater. Since Asian carp establishment in 2000, zooplankton abundance and biomass have both dramatically decreased. Although large bodied cladocerans and copepods were most affected the highly abundant rotifers, dominant in this and other large rivers systems, was also significantly reduced even though rotifer biomass was unaffected. Plankton community composition and dominance shifts markedly as carp arrived in 2000 but, to date, the localized removal efforts of a commercial fishing program have not reversed these shifts, even at a local level.

VULNERABILITY OF COASTAL CUTTHROAT TROUT TO CHANGES IN STREAM TEMPERATURE AND FLOW IN COASTAL STREAMS OF THE PACIFIC NORTHWEST OF NORTH AMERICA

Penaluna, Brooke

103AB
Monday, 18 May, 2015 14:45 - 15:00

Climate change is affecting animals around the globe. Throughout the range of Coastal Cutthroat trout in western North America, stream temperature and flow are expected to become more variable leading to increases in uncertainty related to how they will influence trout. Here, we use a scenario-neutral approach to evaluate the sensitivity of Coastal Cutthroat Trout (Oncorhynchus clarkii clarkii) populations to a plausible range of gradual changes expressed as separate and combined effects of stream temperature and flow. We use an individual-based model heavily parameterized with field data of geophysical template, trout abundance, and environmental regimes collected in Coastal streams of California and Oregon. The model tracks individual trout through daily processes of spawning, movement, feeding, growth, and mortality for six decades. Our results show that stream-trout persist with extreme changes in temperature and flow, but with seriously reduced biomass. Minimal changes to stream temperature and flow lead populations to maintain or increase biomass. Our findings provide managers with enough information on trout responses to incorporate new climate change projections that may arise from new climate models when they are available.

DEFINING PROTECTION FOR THE WORLD'S RIVERS: A NEW GLOBAL METRIC

Abell, Robin

103C
Monday, 18 May, 2015 14:45 - 15:00

David Allan’s work bridging stream ecology and conservation has inspired and guided a new generation of freshwater conservation biologists. Among the areas of conservation science growing out of his work is a focus on the potential of protected areas (PAs) to benefit freshwaters. PAs are a cornerstone strategy for terrestrial and increasingly marine conservation, but their use in freshwaters has received far less attention, especially within global PA gap assessments. In part this is because defining and evaluating ‘protection’ for freshwaters is complicated by the link of aquatic integrity to impacts in upstream catchments. As well, high-resolution maps of the world’s freshwaters have been lacking. Now, with new, highly accurate global datasets of running waters, we can assess how upstream or upland activities may compromise ‘protected’ rivers. We have developed and applied, globally, a measure of riverine protection that integrates both local and upstream catchment protection and present the results here. Our scalable metric can be applied to evaluating progress toward the Convention on Biological Diversity target of 17% protection for inland waters.

DO FRESHWATER MUSSELS AFFECT MERCURY CONTAMINATION OF AQUATIC FOOD WEBS?

Tweedy, Brent; Vaughn, Caryn C.

102B
Monday, 18 May, 2015 14:45 - 15:00

Freshwater mussels are an important part of many freshwater ecosystems throughout North America. Mussels drive many significant ecosystem processes in lakes and rivers that link the water column and sediments, such as the conversion of mercury (Hg) found in sediments into highly toxic methylmercury (MeHg) that is released into the water column and subsequently aquatic food webs. Because of mussels' important role in driving ecosystem function, we hypothesized that they regulate the production and/or release of MeHg. We tested this hypothesis with a field survey and a mesocosm study. We sampled fish and habitat parameters at sites with and without mussels and measured Hg contamination. We found no difference in Hg contamination of fish between mussel positive and negative sites. The follow-up mesocosm study used eight replicates of none, low (4), medium (10), and high (16) mussel density treatments. We collected emergent insects and snails for Hg analysis as well as abiotic parameters. Analysis of the samples is currently ongoing.

ANNELIDICALLY SPEAKING – 2015

Wetzel, Mark J.

101CD
Monday, 18 May, 2015 14:45 - 15:00

This presentation will highlight 1) Nomenclatura Oligochaetologica – Secundus Emendo – a web-based global catalogue of names, descriptions, and type specimens of the Oligochaeta; 2) the status of aquatic, semi-aquatic, limicolous, and terrestrial oligochaetes in North America; 3) distributional records for Slavina evelinae, Branchiodrilus hortensis, Ripistes parasita, and several other aquatic oligochaetes considered introductions to North American waters; 4) freshwater oligochaetes associated with natural and anthropogenic phytotelmata in the Florida Keys, and 5) a timeline for a new guide to aquatic oligochaetes of North America.

DOES RECALCITRANT LEAF LITTER PROVIDE MORE ENERGY TO THE MACROSCOPIC FOOD WEB? A TEST USING THE POPULUS HYBRIDIZING SYSTEM

Compson, Zacchaeus; Hungate, Bruce; Whitham, Thomas; Koch, George; Rakestraw, David ; Schuettenberg, Alexa; Jacobs, Ryan; Allred, Kiel; Sayer, Chelsea; Maestas, Jesse; Marks, Jane

102DE
Monday, 18 May, 2015 14:45 - 15:00

We examined the hypothesis that slow-decomposing, recalcitrant leaf litter would better support the macroscopic food web than fast-decomposing, labile leaf litter, which runs contrary to the prevalent idea that fast-decomposing litter is a higher “quality” resource. Using lab mesocosm studies and a field study with double-labeled litter (13C and 15N), we measured preference, processing, assimilation, and growth rates of Hesperophylax designatus when given litter of different chemical and physical phenotypes from cottonwood species, cross types, and genotypes. Five patterns emerged. (1) H. designatus initially chose more labile leaf litter types, but preference changed quickly to more recalcitrant litter. (2) H. designatus processed more recalcitrant leaf litter (higher % lignin and % condensed tannins). (3) Carbon and nitrogen fluxes from leaf litter to H. designatus were higher for recalcitrant (higher % lignin) compared to labile (lower % lignin) litter types. (4) H. designatus growth rates were higher on recalcitrant leaf litter. Collectively, these results suggest that recalcitrant leaf litter is a more stable, slow-release resource that provides more energy to the macroscopic food web.

PRIMARY PRODUCTIVITY REDUCES METHYLMERCURY BIOACCUMULATION IN EXPERIMENTAL STREAM FOOD WEBS

Walters, David; Raikow, David; Hammerschmidt, Chad; Mehling, Molly; kovach, Amanda; Oris, James

102DE
Monday, 18 May, 2015 15:30 - 15:45

Competing hypotheses posit that increasing primary productivity should result in either greater or lesser contaminant accumulation in stream food webs. We conducted an experiment to evaluate primary productivity effects on MeHg accumulation in stream consumers. We varied light for sixteen artificial streams creating a productivity gradient (oxygen production = 0.048 – 0.71 mg oxygen/L/d) among streams. Two-level food webs were established consisting of phytoplankton/filtering clam, periphyton/grazing snail, and leaves/shredding amphipod (Hyalella azteca). Methylmercury removal from the water column increased significantly with productivity. Phytoplankton and periphyton biomass increased significantly across the productivity gradient, but MeHg concentrations per unit chlorophyll-a declined. Methylmercury in clams and snails also declined with productivity, and consumer concentrations were strongly correlated with primary producer concentrations. Heterotroph biomass on leaves, MeHg in leaves, and MeHg in Hyalella were unrelated to stream productivity. Our results support the hypothesis that contaminant accumulation declines with stream primary production via the mechanism of bloom dilution (MeHg burden per cell decreases in algal blooms), extending patterns of contaminant accumulation documented in lakes to lotic systems.

USING MIMS TO MEASURE RIVERINE SEDIMENT, WATER-COLUMN, AND OPEN-CHANNEL DENITRIFICATION

Reisinger, Alexander J.; Tank, Jennifer L.; Hoellein, Timothy; Hall, Robert O.

101B
Monday, 18 May, 2015 15:30 - 15:45

Denitrification permanently removes nitrogen (N) from aquatic ecosystems, but is difficult to quantify. Commonly-used methods either introduce artificial conditions or can be prohibitively expensive. In particular, accurate riverine estimates are lacking. We used membrane-inlet mass spectrometry (MIMS), mesocosm incubations, and a new modeling approach to partition net N2-flux in sediments and the water-column of 5 Midwestern rivers spanning a nitrate-N gradient. Sediment denitrification ranged from 0.6-1.8 mgN/m2/h, and water-column denitrification ranged from 0-5.2 mgN/m2/h, while one site exhibited net N-fixation. The importance of water-column denitrification relative to the sediment decreased with human land-use. We also estimated whole-river denitrification at one river using a diel, open-channel approach based on whole-stream metabolism methods. Whole-river denitrification was 14.7 mgN/m2/h (95% credible interval =10.0-19.6 mgN/m2/h), which is higher than combined mesocosm estimates from the same river, and LINXII 15N-tracer estimates from headwater streams. This open-channel modeling approach provides a novel, integrative method to estimate riverine denitrification rates. Our denitrification rates, measured across riverine habitats and at the whole-river scale, suggest that rivers remove N at rates comparable to, or even higher than, headwater streams.

SYNTHESIS OF STREAM ECOSYSTEM RESPONSES TO NUTRIENT ENRICHMENT AT MULTIPLE TROPHIC LEVELS

Zeglin, Lydia; Cooper, Scott; Utz, Ryan; Ardon-Sayao, Marcelo; Bixby, Rebecca; Burdett, Ayesha; Dodds, Walter; Griffiths, Natalie A.; Harms, Tamara; Johnson, Laura; Johnson, Sherri; Jones, Jeremy; Kominoski, John; McDowell, William H.; Rosemond, Amy D. ;

103DE
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Globally, many stream and river ecosystems have received increased inputs of nitrogen and phosphorus from anthropogenic activities, spurring extensive research into the consequences of nutrient enrichment on lotic organisms. However, an assessment of nutrient enrichment effects on lotic biomass and production at multiple trophic levels and across sites is lacking. We conducted a metaanalysis of published studies that measured the effects of experimentally increased nitrogen or phosphorus in streams or rivers. We predicted that response magnitudes would attenuate with increasing trophic level, and that ambient stream characteristics would moderate responses. Results showed positive responses to enrichment for both biomass stocks (+43.2±2.0%) and production rates (+32.2±2.9%) across all trophic levels, with no differences among trophic levels. The strongest factors correlating with enrichment responses included background inorganic N concentrations (negative) and temperature (positive). The synthesis also identified methodological impacts on response magnitudes, and a paucity of information on consumer and whole-ecosystem responses. The consistent stimulation of biotic responses at all trophic levels by nutrient addition highlights the importance of controlling nitrogen and phosphorus concentrations in streams and rivers.

ASSESSING THE POTENTIAL ROLE OF ROUND GOBY AS A CONDUIT FOR AVIAN BOTULISM IN LAKE MICHIGAN

Turschak, Benjamin; Bootsma, Harvey; Moraska Lafrancois, Brenda

101A
Monday, 18 May, 2015 15:30 - 15:45

Invasive species from the Ponto-Caspian region have been implicated in restructuring of the Lake Michigan food web over the past several decades. These changes have been coincident with a major increase in the number of bird deaths associated with avian botulism. Round goby, one of the most prolific invaders, now constitute a major prey resource for piscivorous birds. We investigated the trophic role of gobies in the emerging food web as well as seasonal behavior patterns and their relationship to botulism outbreak events in the Sleeping Bear Dunes National Lakeshore region of Lake Michigan. Stable C and N isotopes and gut content analysis were used to assess trophic role, and time lapse imagery was used to capture temporal abundance patterns of goby during the study period, 2010-2014. Our results suggest a potential trophic pathway for the botulinum toxin to pass from hypoxia-tolerant benthic invertebrates, such as chironomids, to gobies which are then susceptible to avian predation. Temporal increases in goby abundance over hypoxic sediments appear to be synchronized with annual bird migrations through the study region.

FRESHWATER LEECHES OF NORTH AMERICA

Govedich, Fredric; Bain, Bonnie

101CD
Monday, 18 May, 2015 15:30 - 15:45

Leeches (Hirudinida) are an important component of most freshwater lakes, ponds, and quieter flowing sections of streams and rivers with other species occurring in marine and terrestrial habitats. There are approximately one hundred described species in North America. The majority of North American leeches are predators that feed on a variety of invertebrate prey including chironomids, oligochaetes, amphipods, and molluscs. Other leech species are temporary sanguivorous (blood-feeding) ectoparasites of vertebrates including fish, turtles, amphibians, crocodilians, water birds, and occasionally humans. Leeches can be recognized by having segmented bodies (annelids) with anterior and posterior suckers and feed by a variety of methods, including: using a proboscis, engulfing and two or three jaws. Identification of leeches can often be difficult due to difficulties properly collecting and preserving species and the specialized nature of keys. The goal of this presentation is to provide information on how to collect, preserve and identify freshwater leeches.

HISTORIC MUSSEL SHELLS ILLUMINATE LEGACY CONTAMINANT PATTERNS OVER THE PAST 1000 YEARS

Shoults-Wilson, Aaron; Fritts, Andrea; Unrine, Jason; Fritts, Mark; Casper, Andrew

102B
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Potentially Toxic Trace Elements (PTTEs) released by human activity can be especially pernicious in aquatic environments since they do not break down over time. Bivalves are considered ideal organisms to use as biomonitors of PTTEs because of their longevity, filter-feeding habit, and relatively sessile nature. We examined historic mussel shells that date back to the 1870s and archeological specimens from 1000 A.D., which provided a pre-industrial environmental baseline of metal concentrations. Mussel shells were thin-sectioned, aged, and then analyzed for trace element concentration. Concentrations of As, Co, Cu, Fe, Mn, Ni and Zn were readily detected in most shells, while concentrations of Al, Cr, Hg, Pb, Se and V were below detection in most shells. Cd and U were occasionally detectable. Shells collected at time points ranging from 1897-2013 had significantly higher concentrations of As, Co, and Cu than archaeological shells. Samples from 1897 to 2013 also showed a significant positive correlation between concentration and time for Co, Cu, and Fe. These results indicate the presence of anthropogenic PTTEs and can be used to elucidate historic trends in contamination.

VARIABLE COUPLING OF CARBON, NITROGEN, AND PHOSPHORUS CONCENTRATIONS DURING BASEFLOW AND STORMS IN A SUBURBANIZING WATERSHED

Carey, Richard; Wollheim, Wil; Mulukutla, Gopal

102C
Monday, 18 May, 2015 15:30 - 15:45

The carbon (C), nitrogen (N), and phosphorus (P) cycles are strongly coupled but humans are changing the nature of the coupling. Previous studies revealed coupled relationships between nitrate-N (NO3-N) and both dissolved organic C (DOC) and phosphate (SRP) in streams during baseflow. However, non-point exports occur predominantly during storms and C-N-P dynamics during episodic events are not well understood. We used in situ sensors to simultaneously measure DOC, NO3-N, SRP, and chloride (Cl), a conservative tracer, in a suburbanizing New Hampshire watershed (479 km2) between April and December 2011 to determine whether C-N-P coupled export changes during storms. DOC and NO3-N concentrations had an inverse relationship under baseflow conditions, similar to previous findings, but often became positively correlated during storms. NO3-N increased with Cl during both baseflow and storms, while DOC declined with increasing Cl. NO3-N and SRP were positively correlated throughout the study, but the relative timing of peak N and P concentrations varied. The transport of C-N-P during storms contrasts with microbially mediated processes during baseflow that can affect the apparent coupling of C-N-P exports from watersheds.

VALUING FISH BIOMASS PRODUCTION AS A PROVISIONING SERVICE OF MICHIGAN RIVERS

Esselman, Peter; Melstrom, Richard; Stevenson, Jan; Lupi, Frank ; Riseng, Catherine ; Wiley, Mike

103C
Monday, 18 May, 2015 15:30 - 15:45

The increased integration of ecosystem services into resource management places renewed emphasis on mapping and valuation of provisioning services of nature. This paper describes a multi-model that links the demand for recreational stream fishing to game fish biomass for rivers of Michigan. We used boosted regression trees to predict spatially continuous patterns of fish biomass, and to identify the strongest landscape constraints on fish productivity. Fitted models were highly significant and explained between 22 and 56% of variation in validation datasets. We combined spatially explicit fish biomass estimates with fishing trip information from a 2008–2010 survey of Michigan anglers to estimate an economic demand model. Fishing sites in the angler choice set were defined by biomass aggregated to the area of small subwatersheds. The results indicated a significant relationship between the site choices of anglers and the biomass of certain species. The fitted economic model was used to estimate the dollar value of several landscape change scenarios, providing a direct estimate of potential ecosystem service benefits derived from Michigan rivers.

COLONIZATION AND SURVIVORSHIP OF SHREDDER TAXA DURING A LONG-TERM ECOSYSTEM-LEVEL LITTER EXCLUSION, WOOD REMOVAL AND LEAF-ADDITION EXPERIMENT

Wallace, J. Bruce ; Eggert, Sue; Webster, Jackson R.; Meyer, Judy L.

103AB
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We follow colonization and survivorship by eight dominant shredder taxa in a southern Appalachian stream through a series of ecosystem-level experiments, including: leaf litter exclusion (3-y), small wood removal (2-y), large wood removal (2-y), PVC addition (1-y), followed by 5-y of leaf additions while maintaining the exclusion canopy throughout the series of experiments. Compared with those of a nearby reference stream, populations of each shredder taxon were drastically reduced during organic matter exclusion and/or wood removal and PVC addition, but Pycnopsyche (Trichoptera: Limnephilidae) exhibited the most pronounced response to initial litter exclusion. Early to mid-size classes were most affected with little evidence of completion of life cycles during organic matter reduction. Survivorship curves were truncated in the organic matter reduction stream. With exception of Molophilus (Diptera: Tipulidae) survivorship curves were clearly Type III. Leaf addition resulted in shredder survivorship curves that were similar to those of the reference stream. Our study underscores the significance of detrital inputs, especially leaf litter as the main food base of headwater streams draining forested catchments.

LAND-USE PROXIES FOR AQUATIC SPECIES INVASIONS IN THE LAURENTIAN GREAT LAKES

O'Malia, Elon; Hoffman, Joel

101A
Monday, 18 May, 2015 15:45 - 16:00

Aquatic invasive species adversely impact ecosystems, human health, and the economy of the Laurentian Great Lakes region. Targeted preventative and eradication efforts in response to early detection of invasive species can be both cost advantageous and effective. But where should we focus limited time and resources searching for the next new invader. I investigated land-use metrics of three prominent anthropogenic introduction pathways (commercial boat traffic, recreational boat traffic, and live release from urban centers), to explain the apparent spatio-temporal patterns of historic aquatic invasions. Of those evaluated, city population size was the best indicator of aquatic invasive species presence and richness, even for species introduced through ballast water discharge. Near shore waters adjacent to large cities had a much higher probability of species presence than medium or small cities. Additionally, commercial boat traffic was a significant indicator of where initial introductions occurred, but was inconsistent at predicting spread post-introduction. Developing and evaluating indicators of historic aquatic invasions will guide future early detection efforts to slow and prevent new introductions.

OBSERVATIONS ON VARIABILITY IN SELENIUM BIOACCUMULATION RATES AND IMPLEMENTATION OF TISSUE CRITERIA

Yeager-Armstead Ph.D., Mindy; Wilson M.S., Mandee; Kinney M.S., Lorin

102DE
Monday, 18 May, 2015 15:45 - 16:00

Chronic tissue criteria for selenium are under consideration nationally and being developed in West Virginia. Implementation of tissue criteria raises many questions with regard to monitoring and attainment of the chronic criterion such as when sampling should occur, which sexes should be included in the monitoring, number of fish included, and whether samples should be composited. Bioaccumulation varies within different ranges of water column concentrations which may affect variability and thus monitoring strategy. To provide insights into these questions, fish were collected monthly for a year at three sample sites with varying concentrations in the mining region of West Virginia. Significant differences between male and female selenium concentrations were only found in the spring season. This season is unfavorable for monitoring due to spawning season however it also corresponds to the highest selenium concentrations for both male and female fish. Fall and winter had the significantly lower selenium concentrations in fish tissue with spring concentrations being intermediate. Sample sizes necessary to approximate the distribution of larger datasets will be presented along with comparisons of composite and individual sampling.

THE ROLE OF FRESHWATER FISHERIES IN MAINTAINING FOOD SECURITY AND BIODIVERSITY

McIntyre, Dr. Peter; Reidy Liermann, Catherine; Revenga, Carmen

103C
Monday, 18 May, 2015 15:45 - 16:00

Fisheries are an essential ecosystem service, but catches from freshwaters are often overlooked. Inspired by Dave Allan's seminal synthesis of overfishing patterns in inland waters, we have developed a high-resolution global map of riverine fisheries to assess how these harvests affect biodiversity and food security. River discharge and human population density are the best predictors of fishery productivity, and 90% of global catch comes from rivers with above-average threat levels. Fish richness and catches are positively but not causally correlated, revealing that fishing is most intensive in rivers where potential impacts on biodiversity are highest. We find that impoverished and undernourished people depend disproportionately on wild-caught fish from rivers compared to marine or aquaculture sources. Ongoing degradation of river habitats is likely to undercut critical fisheries, thereby jeopardizing sustainable local protein sources for the world's poor. These results add to Allan's argument that inland over-fishing merits greater attention from the conservation and fisheries communities.

CHOOSING A MODEL FOR MANAGING NUTRIENTS IN RUNNING WATERS: FORWARD SELECTION OR BACKWARDS ELIMINATION?

Miltner, Robert

103DE
Monday, 18 May, 2015 15:45 - 16:00

Investments made under the aegis of the Clean Water Act historically involved varying levels of uncertainty with regard to return. The Construction Grants program to implement secondary treatment was predicated on the certainty that removing carbonaceous wastes from receiving streams would improve water quality. However, calls for advanced treatment aimed at ammonia nitrogen were often contended by the regulated community for having an uncertain return, despite the well-established toxicity of un-ionized ammonia. Today, oxygen demand and ammonia nitrogen are routinely monitored, and are standard permit elements. Managing those parameters can be viewed as happening in a forward direction: a measured or modeled concentration can be compared to a broadly applicable standard, and remedial action taken as necessary with a high degree of certainty for material benefit. Measureable changes in rivers occur over a gradient of increasing nutrient concentrations, offering some prospect for forward management; however, variability in the nutrient-water quality relationship requires site-specific knowledge to position a water body on the enrichment continuum prior to management.

THE CONCEPT OF INCIDENCE RARITY, ILLUSTRATED BY THE FRESHWATER GASTROPOD FAUNA OF U.S. ATLANTIC DRAINAGES

Dillon, Jr., Robert T.

101CD
Monday, 18 May, 2015 15:45 - 16:00

Our database currently contains 11,471 records of 67 freshwater gastropod species inhabiting Atlantic watersheds from Georgia to the New York line. The incidence distribution appears bimodal, with one peak around 20-30 records and a second peak in the 200-400 range. Adopting the quartile system of Gaston, we suggest that the 0.25(67)=17 species in the left tail of this incidence distribution be defined as "rare," specially designating the leftmost 5% as rank I-1 and the next 20% as rank I-2. The remaining 50 species we divide equally into ranks of increasing incidence I-3, I-4, and I-5. We define species as "marginal" if evidence suggests that they demonstrate below-median incidence in U.S. Atlantic drainages, but above-median incidence elsewhere. Then seven I-1 and I-2 species are "pseudorare" in our study area, being designated I-1m and I-2m. And an equal number of I-3 species must demonstrate the phenomenon that Gaston terms "non-apparent rarity." The relationship between the objective system of incidence rarity here proposed previous subjective systems of ranking by "conservation status" is explored.

HEAVY METAL CONTENT OF WATER, SEDIMENT AND FISH (CHRYSICHTHYS NIGRODIGITATUS, LACÉPÈDE, 1803) FROM INDUSTRIAL EFFLUENT-POLLUTED AQUATIC ECOSYSTEM IN LAGOS, NIGERIA

NDIMELE, PRINCE EMEKA; OWODEINDE, FATAI GBOLAHAN; Whenu, Olusegun Olufemi; NDIMELE, CHINATU CHARITY

102B
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Some physico-chemical parameters and heavy metal content of water, sediment and a commercially important fish (Chrysichthys nigrodigitatus) from Lagos Lagoon complex were studied for ten months (July, 2012 – April, 2013). Three sampling stations (Ologe, Ijon and Etegbin) were chosen based on proximity to points of discharge of effluents and human activities. The heavy metals investigated are Cu, Zn, Pb and Fe while the physico-chemical parameters are temperature, pH, conductivity, TDS, TSS, salinity, dissolved oxygen, BOD, COD, and alkalinity. All the heavy metals studied showed significant ($p<0.05$) monthly and seasonal variation in sediment and tissue of Chrysichthys nigrodigitatus. However, only Zn showed significant ($p<0.05$) monthly and seasonal variation in the water column of the sampling stations. The values of copper and iron obtained in this study are higher than the limits recommended by WHO and USEPA. This study shows that copper and iron concentrations of the sampling stations are increasing. Therefore, there is need for regular monitoring of heavy metals in these water bodies to promptly detect sudden increases and take necessary steps to prevent their harmful effects on man.

WATERSHED LAND USE EFFECTS ON COUPLED NITROGEN AND PHOSPHORUS RELATIONSHIPS IN U.S. STREAMS AND RIVERS

Manning, David; Rosemond, Amy D. ; Benstead, Jonathan P. ; Kominoski, John; Bumpers, Phillip M.

102C
Monday, 18 May, 2015 15:45 - 16:00

Strategies to establish nutrient criteria for streams and rivers currently overlook coupling of nitrogen (N) and phosphorus (P) concentrations and how relative N and P availability changes with land use and stream size. We analyzed publicly available data for patterns in total and dissolved inorganic N and P (TN, TP, DIN, DIP) concentrations by watershed area and land-use category. Highest mean TN and DIN concentrations were in agricultural watersheds (4.3 and 3.3 mg L-1, respectively; ANOVA P<<0.05); highest mean TP and DIP concentrations were in urban watersheds (0.33 and 0.19 mg L-1, respectively; ANOVA P<<0.05). Relative molar ratios of N and P followed this pattern: streamwater N:P was higher in agricultural (153:1) vs. urban watersheds (72:1; ANOVA P<<0.05). N:P ratios in particulate matter indicated stoichiometric control of uptake of excess nutrients, especially of N. Particulate N:P was relatively invariant across streamwater N:P availability, implying stoichiometric regulation of N and P uptake. Our analysis reveals a robust signature of stoichiometric coupling of N and P uptake in streams and rivers, explaining patterns in nutrient export with increased N and P loading.

WEAK EFFECTS OF HOME-FIELD ADVANTAGE ON THE AQUATIC DECOMPOSITION AND COLONIZATION OF HIGH-QUALITY LEAF LITTER

Yeung, Alex; Richardson, John

103AB
Monday, 18 May, 2015 15:45 - 16:00

Terrestrial decomposers are often suggested to process locally derived plant materials more efficiently than foreign ones, thereby accelerating litter decay at their home relative to away region. This ‘home-field advantage’ (HFA) can even exist among streams as close as 5 km apart. HFA effects on decomposition were tested over a broad geographic scale using a reciprocal litter transplant experiment in Canadian headwater streams. Home-region litter collections of speckled alder (Alnus rugosa; Ontario) and red alder (A. rubra; British Columbia) were made, which were absent in the away regions. They were decomposed in both regions with contrasting riparian vegetation (Ontario: deciduous-dominated; British Columbia: coniferous-dominated). Coarse- and fine-mesh packs were used to investigate how HFA interacted with shredder- and microbe-mediated decomposition. Net HFA effects on decomposition were weak and not statistically different from zero (shredder-mediated: 7%; microbe-mediated: -0.7%). Fungal and algal colonization of litter were similar across regions. Nutrient-limited decomposers, particularly microbes, likely responded strongly to foreign high-quality litter, which enhanced the decomposition of A. rugosa in the coniferous-dominated away region. Inter-site differences in nutrient availability and hydrologic regime potentially also obscured HFA effects.

TEMPORAL VARIATION OF AMMONIA UPTAKE IN A TROPICAL STREAM

Tromboni, Flavia; Zandona, Eugenia; Lourenço-Amorim, Christine; Neres-Lima, Vinicius; F. Silva-Júnior, Eduardo; Feijó de Lima, Rafael; Moulton, Timothy; Thomas, Steven

101B
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We conducted a series of slug nutrient additions in a Brazilian tropical stream to examine how ambient uptake rates and uptake kinetics change over time and in response to phosphorus amendments. TASCC style nutrient additions were conducted four times from June 2013 to November 2014. Each time, slug additions a conservative tracer (NaCl) combined with ammonium and ammonium + phosphate were conducted in the same 307m reach of a pristine stream (Barra Pequena) in Ilha Grande, Brazil. Additions were conducted over sequential days to minimize the influence of changing hydrological conditions. Ambient estimates of ammonium uptake lengths (Sw) and uptake rates (U) varied across time (244-720m and 0.30-0.72 mg N m-2 hr-1, respectively). Ambient Sw and U estimates varied relatively little between additions of ammonium alone and when ammonium was added with phosphorus additions. Similarly, the response of uptake rate to changing concentrations varied through time but was relatively insensitive to P addition. These results support results from nutrient diffusing substrates experiments that this stream remains N limited throughout the year, but document temporal variations in N uptake and retention.

LONG-TERM PHOSPHORUS TRENDS IN WISCONSIN LAKES

Hein, Catherine

102C
Monday, 18 May, 2015 16:00 - 16:15

Anthropogenic nutrient loading is a major stressor of lakes worldwide. Although watershed management efforts have reduced nutrient loading, eutrophication may worsen as agriculture expands, land develops, and precipitation intensifies. The Wisconsin Department of Natural Resources has been collecting total phosphorus (TP) on 62 lakes for up to 45 years, providing an opportunity to test whether phosphorus concentrations have changed over time. These lakes occur throughout the state in agricultural, urbanized, and forested watersheds and range in size, trophic status, and hydrology. I used linear models to test for change in annual mean TP over time. Total phosphorus significantly increased in 6 lakes, decreased in 8 lakes, and did not change in 44 lakes. Lakes with a decreasing trend were located in southern Wisconsin watersheds with significantly more developed land. Most lakes with an increasing trend were deep and in forested, northern watersheds. Long-term data sets such as this one elucidate trends in time and space and provide opportunity to understand causes of change, be they environmental drivers or the result of direct management actions.

PATTERNS OF DISSOLVED ORGANIC NITROGEN (DON) PRODUCTION AND CONSUMPTION WITH THE ADDITION OF NITRATE (NO3): INSIGHTS INTO THE CONTROLS ON DON CYCLING

Wymore, Adam; Rodriguez-Cardona, Bianca; McDowell, William H.

103AB
Monday, 18 May, 2015 16:00 - 16:15

Despite decades of research documenting the quantitative significance of dissolved organic nitrogen (DON) in the nitrogen cycle of forests, tundra, and streams, the drivers controlling its production and consumption remain elusive. One hypothesized control on DON in streams is nitrate (NO3) availability; however, the majority of work examining this relationship has been via synoptic surveys which has produced inconsistent spatial and temporal patterns. The objective of this research was to provide direct experimental evidence documenting ways in which NO3 availability controls DON concentrations in streams. Using the framework for solute analysis provided by Tracer Additions for Spiraling Curve Characterization (TASCC), we performed a series of experiments in New Hampshire headwater streams that manipulated NO3 and measured the response of the manipulated solute and ambient DON. Although results indicate that DON is primarily used as a nutrient source in these streams (net DON accumulation with added NO3), strong underlying seasonal patterns are discernible when the data are analyzed at the monthly scale. Evidence overall suggests that DON can be used as both a nutrient source and as an energy source.

ASSESSING THE VALUE OF OUTREACH TO BOATERS AS A TOOL FOR REDUCING INTRODUCTION AND SPREAD OF INVASIVE AQUATIC SPECIES

Keller, Reuben; Cole, Ellen; Garbach, Kelly

101A
Monday, 18 May, 2015 16:00 - 16:15

Freshwater invasive species continue to arrive, become established, and spread in the US. Recreational boating is a strong vector for these species and extensive resources are devoted to outreach programs encouraging boaters to modify their behaviors. Little work has been conducted, however, to determine whether this outreach is effective in reducing the spread and impacts from invasive species. We conducted a survey (n=556 respondents) in Illinois to determine the relationship between the practices of boaters and their exposure to outreach messages. We found that although most boaters have received outreach messages and are familiar with the problems of invasive species, over 20% do not actively remove organisms from their boats. Almost all lakes remain exposed to this high-risk group; of 35 lakes examined we found that all were visited during a 12 month period by boaters who do not make efforts to clean their boats. Although outreach efforts appear to be successful at reaching the majority of boaters and affecting their behaviors, reducing invasion rates may require new approaches that focus on boaters that have not adopted these behaviors.

POTENTIAL EFFECTS OF CLIMATE ON THE BIOACCUMULATION OF MERCURY IN TWO LARGE-BODIED FISH SPECIES IN NORTHERN ONTARIO

Sumner, Alexandra; Johnston, Tom; Gunn, John

102B
Monday, 18 May, 2015 16:00 - 16:15

Increasing temperatures in Canada's subarctic region are expected to alter many components of aquatic ecosystems, including mercury bioaccumulation in fish. It is important to understand how current climate trends influence the concentration of this neurotoxin in fish in order to assess the future impacts that climate change might have on the safety of consuming wild fish in Ontario. To better understand how climate influences mercury bioaccumulation, I am investigating patterns of fish mercury concentrations across a climatic gradient in Ontario. Two species of large-bodied fish, walleye and white sucker, have been sampled from 75 lakes throughout the Near and Far North of Ontario. These lakes are distributed over 9.0° of latitude and represent a range of climatic conditions (annual growing degree days 604-1599). Additionally, fish mercury concentrations are being analyzed with respect to chemical, physical, and biological variables known to be influential. The results of this study will address important gaps in our current understanding of how climate affects fish mercury, and will be useful in assessing reference conditions in advance of further climate change.

WHAT WE CAN AND CANNOT LEARN FROM SLUG ADDITIONS OF NUTRIENTS

Thomas, Steven; Tromboni, Flavia; Kohler, Brady; MacNeill, Keeley; Zandona, Eugenia

101B
Monday, 18 May, 2015 16:00 - 16:15

Researchers are increasingly using slug approaches to characterize nutrient uptake in streams. Increased application of slug techniques, as opposed to plateau methods, stems directly from the publication of the TASCC method (Covino et al. 2010). We conducted more than 50 of these additions across a broad geographic range using various nutrients and experimental designs. We use these results to provide a critical review of this method with respect to its ability to estimate uptake characteristics under ambient conditions and to characterize the relationship between uptake and nutrient concentration. TASCC results often identify differential behavior on the rising and falling limb of the relationship between enrichment concentration and estimates of uptake length (Sw) and uptake rate (U). We argue that hysteresis in these relationship reflects the relationship between U and concentration and the influence of differential uptake rates occurring along individual flowpaths. We use a combination of empirical and modeling approaches to describe these relationships, categorize and interpret different hysteresis patterns, and to provide overall recommendations for how to interpret these results.

AN INTRODUCTION TO SAFIT; THE SOUTHWEST ASSOCIATION OF FRESHWATER INVERTEBRATE TAXONOMISTS

Rogers, Christopher

101CD
Monday, 18 May, 2015 16:00 - 16:15

SAFIT is an independent, nonprofit organization of professional invertebrate biologists whose mission is to promote standardized freshwater invertebrate taxonomy in support of aquatic ecosystem biotic assessments in the southwestern USA. SAFIT is also charged with promoting a better understanding of macroinvertebrate taxonomy and systematics, and fostering scientific research, education, training and professional development of our membership. SAFIT is primarily a support organization for entities conducting aquatic bioassessment.

USE AND INTERPRETATION OF HUMAN DISTURBANCE GRADIENTS FOR CONDITION ASSESSMENT IN GREAT LAKES COASTAL ECOSYSTEMS

Johnson, Lucinda; Allan, David ; Cai, Meijun; Danz, Nicholas; Uzarski, Don

103C
Monday, 18 May, 2015 16:00 - 16:15

The Laurentian Great Lakes and its basin are impacted by multiple stressors that range from chronic to pulse in their temporal dimension and local to regional in their spatial dimension. Successful restoration across a region requires comprehensive data capable of depicting stress types and sources, permitting evaluation, planning, and execution. Two projects (Great Lakes Environmental Indicators (GLEI) and Great Lakes Environmental Assessment Map (GLEAM) have recently characterized human activities across the Great Lakes Basin. The Coastal Wetland Monitoring Program developed a disturbance gradient to represent localized sources of stress, which includes water quality as well as landscape data. These stress gradients each have appropriate uses for predicting stress and establishing stress-response relationships. We will discuss characteristics of each, examine concordance in areas of overlap, and discuss appropriate uses of each gradient.

THE YES, NO, AND MAYBE OF DATA-DRIVEN WATER RESOURCES MANAGEMENT DECISIONS: LESSONS FROM NUMERIC CRITERIA DEVELOPMENT AND USE

McLaughlin, Douglas

103DE
Monday, 18 May, 2015 16:00 - 16:15

There are many situations in water resources management involving the use of continuous data to choose among discrete categories representing possible true conditions of a water resource. One example is deciding whether desired water resource conditions defined by numeric criteria are truly attained, where possible categories include “yes, the condition is attained” or “no, the condition is not attained”. Some degree of decision uncertainty is expected, due, for example, to limited data availability. Such uncertainty may be quantified as a “gray region” that reflects a set of conditions for which a manager may only be able to say “maybe the condition is attained, and maybe it is not”. Such yes-no-maybe situations are a common and important nexus of science, policy, and communication for which continued careful study may yield substantial environmental management benefits. This presentation describes recent examples of yes-no-may be decisions involving numeric water resources criteria for nutrients and metals, and reviews available frameworks for their evaluation. Some useful quantitative tools and future challenges are discussed.

EXPERIMENTAL MIXING OF A NORTH-TEMPERATE LAKE: EXAMINATION OF VARIABILITY IN SPATIAL AUTOCORRELATION IN FISH AND ZOOPLANKTON POPULATIONS

Heald, Emily; Lawson, Zach J.; Hrabik, Thomas R.; Vander Zanden, Jake M.; Carpenter, Stephen R.

102DE
Monday, 18 May, 2015 16:00 - 16:15

Thermal stratification and twice-yearly mixing of freshwater lakes structure physical habitats, affect the rate of chemical and biological processes, influence phenology and distribution of aquatic animals, and drive predator-prey interactions. Because of the far-reaching and complex nature of thermal stratification, whole-ecosystem manipulations are essential to understanding abiotic and biotic interactions that regulate aquatic ecology. The Crystal Lake Mixing Project (Vilas County, WI) has successfully mixed an entire lake, creating an environment to study effects of destratification on spatial distributions of fish and zooplankton before (2010-2011), during (2012-2013), and after (2014) mixing. This manipulation may aid in understanding processes that structure spatial heterogeneity that may in turn drive distributions of fish and zooplankton, and also yield insight on the more general question of how patterns of biotic aggregations respond to disturbance regimes. We will examine changes in spatial autocorrelation of fish and zooplankton using cokriging and variograms to test hypotheses that bottom up or top down mechanisms drive spatial patterns in predator and prey distributions from 2010-2014, and whether mixing alters patterns observed during the pre-manipulation phase of the experiment.

DATA DRIVEN STORM WATER MANAGEMENT FOR STREAM INTEGRITY: AN IMPLEMENTATION TOOL AND STRATEGY

Wooten, Matthew; Hawley, Robert ; MacMannis, Katherine ; Fet, Elizabeth; Korth, Nora

103DE
Monday, 18 May, 2015 16:15 - 16:30

As research progresses and continues to identify the inadequacies of traditional storm water management decisions in terms of the protection of aquatic systems, the need for managing storm water for overall stream integrity is becoming increasingly apparent. Historically, an emphasis was placed on moving storm water away from developed areas as quickly as possible, with the primary focus on flood control. Consequently, little consideration was given to watershed hydrology, physical impacts or the ecological relevance of management decisions. In order to remedy this, SD1, the regional storm water management utility of Northern Kentucky initiated a holistic monitoring effort that includes biological, physical, chemical and hydromodification assessments. The data collected from this effort established baseline stream conditions and allowed for the development of a critical flow (Qcritical) threshold at which stream integrity begins to degrade. This knowledge was then used to create a “Decision Tree” tool that site designers, plan reviewers and watershed managers can use to ensure that management decisions are founded in local data, are environmentally and ecologically relevant, and provide the best means of ecosystem protection.

ASSESSMENT OF MANGANESE, COPPER, NICKEL AND ZINC IN MUSCLE AND LIVER OF THE AFRICAN CATFISH (CLARIAS GARIEPINUS) IN ILUSHI RIVER, SOUTHERN NIGERIA

Izegaegbe, Joshua

102B
Monday, 18 May, 2015 16:15 - 16:30

Assessment of Manganese, Copper, Nickel and Zinc in Muscle and Liver of the African Catfish (Clarias gariepinus) in Ilushi River, Southern Nigeria Izegaegbe Joshua Idowu, Oloye Femi Francis and Oloton Vivian Abstract This study investigated the concentrations of manganese, zinc, copper, and nickel in the liver and muscle of Clarias gariepinus with a view to determining the level of bioaccumulation. Heavy metal determination of digested fish samples was done using the atomic absorption spectrophotometer. The heavy metal load revealed that zinc had the highest mean concentration of 0.217±0.008µg/g in liver and 0.130±0.006µg/g in muscle of Clarias gariepinus while copper recorded the least concentration in liver 0.063±0.004µg/g and 0.027±0.003µg/g muscle of Clarias gariepinus. The results also revealed that the concentration of heavy metals (Mn, Cu, Ni and Zn) found in the liver of Clarias gariepinus was higher than in the muscle of Clarias gariepinus. This indicates that the liver is a better accumulator of heavy metal in Clarias gariepinus. The study shows that heavy metals in liver and muscle were within WHO/FAO permissible limits safe for human consumption.

STABLE ISOTOPE ANALYSIS OF FOOD AVAILABILITY FOR FRESHWATER MUSSELS IN A REGULATED RIVER

Camp, Mieko; Layzer, Jim

103AB
Monday, 18 May, 2015 16:15 - 16:30

Dams are often cited as a primary cause of imperilment for freshwater fauna. Although many of the effects of dams on lotic systems are well understood, little is known about their influence on food availability for freshwater mussels. We selected six sites in the Green River, Kentucky: one reference site upstream of Green River Lake and five sites distributed along a 128-km reach downstream of Green River Dam. Mussel foot tissue (N=498) and food resource (N=218) samples were collected June-October, 2012-2013. We used stable isotope mixing models and water chemistry analysis to examine variation in the quality and quantity of benthic and suspended food items. Food resources varied among sites, but did not present a downstream gradient. The Green River Dam limits transport of phytoplankton early in the growing season (June-August); however, surface releases from the reservoir supplement phytoplankton concentrations immediately downstream of the dam in September and October. Within-site analysis showed differences in the assimilation of food items among mussel species. This study will help identify areas with food resources suitable for reintroducing or augmenting mussel populations.

FOR THE LOVE OF RIVERS: THE POWER OF STORY IN ENGAGING THE PUBLIC IN OUR FRESHWATER FUTURES

Fausch, Kurt

103C
Monday, 18 May, 2015 16:15 - 16:30

Freshwater ecologists strive to provide information and tools so that river managers can balance human needs for water with conserving ecosystems. However, most of this is unknown to the public that provides the political impetus to shape river management. If we want real rivers in our future, then we must help the public understand what is at stake, what humans value, and what it will take to conserve these ecosystems. Here I describe using narrative non-fiction writing to draw readers into a story, educate them about how streams work as a by-product, and ask what is essential about rivers that would compel humans to conserve them. Beyond simply water to drink and grow crops, and fish to eat, humans are hard-wired to seek rivers. Science shows that they can reduce stress and increase happiness, thereby improving creativity and offering solace in times of great loss. Building on this science, the power of story is to help humans understand and achieve a deep love of rivers, and in that find a reason to conserve them.

WHY IS PHYTOPLANKTON PRODUCTION AND ZOOPLANKTON BIOMASS LOWER IN HUMIC LAKES?

Faithfull, Carolyn; Bergström, Ann-Kristin; Deininger, Anne

102DE
Monday, 18 May, 2015 16:15 - 16:30

Small oligotrophic humic lakes are the most numerous type of lake in the boreal zone and will become more abundant as a consequence of climate change. Consequently, it is important to assess why oligotrophic humic lakes have lower primary and secondary production than their clear water counterparts. To determine why humic lakes are less productive than clear water lakes, we compared food quantity and quality measures in four humic and four clear water lakes over a growing season. Food quantity was twice as high in clear water compared to humic lakes, although food quality was higher in humic lakes. Reduced light, light:nutrient supply ratios and lower temperatures were the primary factors limiting phytoplankton production and phytoplankton taxon richness in humic lakes. Zooplankton biomass and taxon richness were positively related to temperature, total nitrogen and phytoplankton production and richness, rather than measures of food quality. Overall, light availability was the most important determinant of phytoplankton production and species diversity, which resulted in differences in zooplankton biomass and species diversity between boreal humic and clear water oligotrophic lakes.

POPULATION COLLAPSE OF INVASIVE RUSTY CRAYFISH IN NORTHWOODS LAKES OF WISCONSIN, USA

Larson, Eric; Kreps, Timothy; Lodge, David

101A
Monday, 18 May, 2015 16:15 - 16:30

The abundance and impacts of nonindigenous species often change through the course of invasion as they alter food webs and ecosystems, but most research occurs at temporal and spatial scales that are too short and small to capture these important dynamics. For example, the prevalence of population "busts" in which established invaders decline or even disappear over time is difficult to evaluate without long-term monitoring of invasions. We use nearly 40 years of data (1975-2014) on the abundance of invasive rusty crayfish in 17 Vilas County, Wisconsin, USA lakes to evaluate the long-term fate of these populations, including whether or not some lakes have experienced busts of previously abundant rusty crayfish. Although rusty crayfish populations have remained high in some lakes, nine lakes (53%) have experienced significant, sustained declines of rusty crayfish from earlier peaks. We discuss potential factors contributing to population collapse of rusty crayfish, including prevalence of crayfish-supporting habitat (e.g., cobble substrate), recent climatic patterns (e.g., drought), and crayfish-parasite dynamics.

STATISTICAL AND ANALYTICAL METHODS FOR ESTIMATING OPEN-CHANNEL METABOLISM IN HIGH-ENERGY STREAMS

Hall, Robert O.; Madinger, Hilary

102C
Monday, 18 May, 2015 16:15 - 16:30

Use of open-channel metabolism methods for streams and rivers has greatly increased. The method works best in streams with low rates of gas exchange (K) where one can simultaneously solve for both metabolism and K. High K complicates estimating metabolism because 1) bubbles oversaturate oxygen, leading to underestimating ecosystem respiration (ER) and small errors in sensor calibration causes large error in ER and 2) high K makes solving for gas exchange using inverse modeling difficult because of parameter equifinality. We addressed 1 using membrane inlet mass spectrometry. Argon was predictably oversaturated in mountain versus lowland streams. Using oxygen to argon ratios, we calibrated sensors throughout their deployment. To address 2, we developed a hierarchical Bayesian metabolism model for multiday (15-70d) oxygen time series. This method borrows strength from all days in a time series to estimate a posterior distribution for K, rather than solving for K on individual days. Hierarchical priors on K allow flexibly incorporating variation due to, e.g., stream discharge. Our approach expands our ability to statistically estimate metabolism to steep, turbulent streams.

AMMONIUM UPTAKE KINETICS AND NITRIFICATION IN STREAMS IN ROCKY MOUNTAIN NATIONAL PARK

Day, Natalie; Hall, Robert O.

101B
Monday, 18 May, 2015 16:15 - 16:30

We conducted pulse NH4+ additions to investigate the kinetics and fate of NH4+ in 3 sub-alpine streams in Rocky Mountain National Park. Mean ambient NH4+ concentrations of the streams ranged from 0.4 to 3.5 µg L-1 NH4+ -N. Mass removal of NH4+ ranged from 38-65 % and 6-33 % was immediately nitrified. We estimated dynamic uptake metrics using the TASCC method. Observed functional relationships of biological uptake with NH4+ concentration were consistent within streams, though not across streams. The relationship between Vf and NH4+ concentration was best described by a efficiency loss model for two streams, in which the log Vf decreased with log NH4+ concentration with a slope <1. Uptake increased with NH4+ concentration in one stream. A Michaelis-Menten saturation model fit our data poorly and a global half saturation constant of 800 µg L-1 NH4+ -N far exceeded our highest concentration of 120 µg L-1 NH4+ -N. A lack of saturation and varied uptake kinetics across streams indicate variation in biological processes not easily characterized by M-M kinetics.

MORE THAN JUST SLIPPERY - THE IMPACT OF BIOFILM ON THE ATTACHMENT OF RUNNING WATER SPECIES EPEORUS ASSIMILS

Ditsche, Petra; Michels, Jan ; Kovalev, Alexander; Koop, Jochen; Gorb, Stanislav

101CD
Monday, 18 May, 2015 16:15 - 16:30

While terrestrial insects usually attach directly to solid substrates like stones or plants, for aquatic insects the situation is more complex due to the growth of biofilm and periphyton on the substrates. Recent investigations indicate that biofilm can strongly influence the ability of benthic animals to attach. This study aimed to prove the impact of biofilm on the attachment of mayfly larvae. We performed attachment experiments in a flow channel, measured attachment forces generated by the claws, and characterised biomechanical properties of the biofilm. The experiments were performed on substrates of different surface roughness each with and without biofilm. On smooth or slightly rough surfaces a layer of biofilm increased the attachment force of claws significantly. The larvae were able to endure higher flow velocities on biofilm-covered smooth substrates in comparison to biofilm-free, smooth substrates. In contrast, on rough substrates the attachment force of claws decreased. Consequently, biofilm is of important ecological relevance for the larvae not only as food source, but also as a factor influencing their attachment ability in natural stream habitats.

A CASCADE OF ECOLOGICAL CONSEQUENCES FOR WEST NILE VIRUS TRANSMISSION WHEN AQUATIC MACROPHYTES INVADE ANTHROPOGENIC STORMWATER HABITATS

Allan, Brian

103C
Monday, 18 May, 2015 16:30 - 16:45

Among David Allan's many contributions to the field of aquatic ecology are the importance of terrestrial inputs to aquatic food webs and the influence of spatial refugia on patterns of insect colonization of aquatic habitats. These same phenomena prove to be highly important in the ecology of mosquito vectors that develop in stormwater habitats. Artificial aquatic habitats are ubiquitous in anthropogenic landscapes and highly susceptible to colonization by invasive plant species. A recent field study demonstrates that the establishment and management of two invasive, emergent plants, cattails (Typha spp.) and phragmites (Phragmites australis), in stormwater dry detention basins alters the local distribution of vectors, avian hosts, and West Nile Virus (WNV) transmission risk in an urban residential setting. Mowing of emergent vegetation, and the subsequent deposition of leaf litter into the aquatic environment, results in a significant and sustained increase in the abundance of WNV-infected vectors. Deposition of emergent leaf litter may have affected an increase in spatial refugia for larval mosquitoes from invertebrate predators, contributing to an overall increase in mosquito production and disease risk.

EFFECTS OF CADMIUM ON THE REPRODUCTION AND OFFSPRING OF THE GREAT POND SNAIL LYMANEA STAGNALIS

Reátegui-Zirena, Evelyn; Fidder, Bridgette; Olson, Adric; Bilbo, Thomas; Dawson, Dan; Salice, Christopher

102B
Monday, 18 May, 2015 16:30 - 16:45

Cadmium is toxic and ubiquitous in natural environments, but its sublethal effects on aquatic organisms are not well understood. The purpose of this study was to evaluate sublethal effects in Lymnaea stagnalis adults exposed to 0, 25, 50, 100, 200 and 400 ppb cadmium for 8 weeks, and to test for potential parental effects in offspring. We evaluated feeding and growth rate, number of egg masses, eggs per egg mass, and abnormal eggs. At three separate time points during the study we also evaluated effects of cadmium on hatching success and time to hatch. Feeding rate, growth rate, number of egg masses and eggs per egg mass decreased with increasing concentrations while the number of abnormal eggs increased. Hatching success did not increase over time. However, in a subsequent cadmium challenge of offspring, snails from parents exposed to the higher concentrations of cadmium were more tolerant to cadmium challenge concentrations. These observations on offspring performance suggest there are important parental effects of toxicants that can strongly influence responses.

EXAMINING STREAM NUTRIENT VARIABILITY IN REFERENCE CATCHMENTS AT US FOREST SERVICE EXPERIMENTAL FORESTS RELATIVE TO PROPOSED NUTRIENT CRITERIA

Rhoades, Chuck; Johnson, Sherri; Sebestyen, Steve; Greathouse, Effie; Ice, George; Knoepp, Jennifer; Amatya, Devendra; Argerich, Alba; Campbell, John; Edwards, Pam; Groffman, Peter; Likens, Gene; Wohlgemuth, Peter

103DE
Monday, 18 May, 2015 16:30 - 16:45

Federal and agencies are attempting to develop criteria to help monitor and sustain clean water and protect aquatic ecosystems. The US Forest Service Experimental Forest Network measures stream chemistry weekly to monthly in unmanaged catchments. Originally designed to evaluate the effects of forest practices and other disturbances across a range of catchment size, vegetation, soil and climate conditions, these data also provide information on variability in stream nutrients for 'least disturbed' conditions. We examined a decade of stream nitrogen concentrations from 19 reference catchments at 10 Experimental Forests and stream phosphorus for a subset of catchments. Stream nitrogen exceeded draft criteria to varying extents at all sites. Total phosphorus was consistently above draft criteria for all western and northern study catchments. Stream nitrate varied 2- to 10-fold among catchments within an Experimental Forest. Differences in physical characteristics and natural disturbance history often outweigh seasonal and regional sources of variability among these reference catchments. Such local variability represents a significant hurdle to development of general stream nutrient criteria aimed at identifying or reducing water quality impairment.

UNDERSTANDING SEDIMENT PHOSPHATE RELEASE UNDER ANOXIC CONDITIONS IN GREEN BAY, LAKE MICHIGAN

LaBuhn, Shelby; Klump, Val; Koopmans, Dirk

101B
Monday, 18 May, 2015 16:30 - 16:45

Green Bay, Lake Michigan is a freshwater estuary that experiences seasonal hypoxia in the southern portion due to a number of reasons, including excess phosphorus inputs resulting in high algal production. The relationship between oxygen and phosphorus in the benthic region of Green Bay, necessary for understanding hypoxia, is not well understood for a number of reasons. One is that sediment oxygen uptake (SOU) is difficult to quantify and highly variable, both spatially and temporally. Second, phosphate release from the sediment has recently been examined in Green Bay sediments during core incubations. This release, which occurs when dissolved oxygen above the sediment is depleted, can spike local phosphate release rates from 6.7 µmol m-2 hr-1 to more than 120 µmol m-2 hr-1 under sustained anoxia. We observed continuous phosphorus concentration increases for 2-3 days, until the experiment was terminated. Our goal is to develop a simple oxygen-phosphorus model for lower Green Bay, crucial for comprehensive understanding of this hypereutrophic system.

UNDERSTANDING POTENTIAL CHANGES IN TROPHIC RELATIONSHIPS USING STABLE ISOTOPES RATIOS FOLLOWING EXTREME RESERVIOR DRAWDOWN

Murphy, Christina; Arismendi, Ivan; Johnson, Sherri

102DE
Monday, 18 May, 2015 16:30 - 16:45

Highly variable and complex food web responses may result from extreme drawdowns of reservoirs. We examined trophic relationships in two reservoirs in the Oregon Cascades with similar community compositions following an extreme drawdown of one reservoir to brief lotic conditions. We hypothesized that in-reservoir food webs and their productivity would show cascading trophic effects following exports of nutrients and taxa downstream; we sampled physical, chemical and biological conditions during summer and fall and analyzed stable isotope ratios of nitrogen, carbon, and sulfur for the food webs. We found a lower maximum nitrogen isotopic ratio in the treatment reservoir, suggesting a shorter food web length that coincided with lower light transmission and a shallower thermocline. Whereas fishes known to be planktivorous had similar isotopic ratios, suspected piscivores were different between the two reservoirs. Our findings could be consistent with either top down or bottom up influences. The extreme drawdown exports many fishes downstream, reducing abundance within the reservoir. Under such conditions, generalist predators may be switching their diets from piscivory to the remaining and more abundant prey (e.g. zooplankton).

SPECIES INTRODUCTION ALTERS NUTRIENT RECYCLING PATTERNS OF INTRODUCED GUPPY FISH AND RESIDENT KILLIFISH SPECIES IN TRINIDAD

Frauendorf, Therese C.; Marques, Piatã S.; Warbanski, Misha; Phillip, Dawn; El-Sabaawi, Rana

101A
Monday, 18 May, 2015 16:30 - 16:45

Species introduction is a significant global problem; yet little is known about the long-term effects of introductions. Guppies (Poecilia reticulata) from Trinidad are used as a model to study the evolutionary and ecological effects of species introductions. We identified sites where guppies were introduced to previously guppy-free stream locations 4, 6, 24, and over 50 years ago. These streams are co-inhabited by native killifish (Anablepsoides hartii) and remained guppy free upstream of these introduction sites. We characterized how fish-mediated nutrient recycling changed over time since invasion, as guppies adapted to their new habitats and caused killifish populations to decline. We measured fish nitrogen excretion rates along the guppy introduction continuum and compared them to upstream guppy-free sites. Guppy excretion rates were highest in recent introductions (avg. 31 ug N/hr/g fish) and steadily declined with time since introduction (to avg. 12 ug N/hr/g fish). Excretion rates of killifish decreased shortly after guppy introductions, but returned to pre-introduction rates within 50 years. We hypothesized that adaptation and competition for food resources between guppies and killifish facilitated these patterns.

FUNGAL CONTRIBUTIONS TO CARBON FLOW AND NUTRIENT CYCLING DURING STANDING TYPHA LEAF DECOMPOSITION: A TALE FROM TWO CLIMATES

Kuehn, Kevin; Su, Rong ; Ohsowski, Brian; Francoeur, Steve ; Phipps, Scott ; Neely, Robert

103AB
Monday, 18 May, 2015 16:30 - 16:45

We examined the contribution of fungi to standing leaf decomposition in Typha domingensis and Typha angustifolia in a subtropical and temperate freshwater marsh, respectively. Typha leaves were collected while living and then periodically during senescence and standing-dead decomposition for one year. Fungal biomass and production rates and losses in leaf carbon were quantified and used to construct a partial decay budget estimating carbon flow into fungi. Significant losses in T. domingensis (37%) and T. angustifolia (55%) leaf carbon were observed during litter decomposition along with concomitant increases in fungal biomass, which reached a maximum of 37±4 and 106±7 mgC/g detrital C in T. domingensis and T. angustifolia, respectively. Cumulative fungal production totaled 39 mgC/g initial detrital C in T. domingensis and 123 mgC/g initial detrital C in T. angustifolia, indicating that 11% and 22% of the Typha leaf C was converted into fungal biomass, respectively. Observed differences in the performance and contribution of fungi to Typha decomposition between the subtropical and temperate marsh sites may be reflected in the differing litter quality observed between these two Typha species.

LAKES TO LANDSCAPES, FISHERIES TO PHOSPHORUS, AND ASSEMBLAGES TO ASSESSMENTS: A 40-YEAR JOURNEY THROUGH (MOSTLY) RUNNING WATERS

Allan, David

103C
Monday, 18 May, 2015 16:45 - 17:00

From the early years of my PhD studies of pond zooplankton to my involvement in Great Lakes work today spans a little more than 45 years, indeed spent mostly in running waters. Heading into the (mostly) retired phase of life seems warranted! Along the way I've worked in a variety of aquatic ecosystems, on issues that span the spectrum from basic to applied, and engaged with various research teams, environmental groups and government agencies. The challenge of unanswered questions and unresolved societal problems, and the colleagues one learns with and from, make the journey rewarding. Occasionally making a useful contribution helps too, but it seems to me that almost all meaningful advances are the work of many. Words cannot express my delight at this opportunity to unite with friends, colleagues, former students and post-docs, and others in reflecting on a meandering career. I am deeply touched and honored.

EFFECTS OF NANOTITANIA ON BENTHIC MICROBIAL COMMUNITIES IN ARTIFICIAL STREAMS

CHU, BINH; Peterson, Christopher; Vigen, Erika; Tong, Tiezheng; Gray, Kimberly; Gaillard, Jean-Francois ; Kelly, John

102B
Monday, 18 May, 2015 16:45 - 17:00

Nano-TiO2 is a widely used nanomaterial with photocatalytic properties whose production is growing rapidly, leading to concerns about the consequences of its release into the environment. We analyzed effects of a common nano-TiO2 pigment (PW6) on benthic microbial communities in artificial streams. Streams included sediment and ceramic tiles (as substrates for biofilm formation) and were inoculated with a mixed microbial consortia collected from a natural stream. PW6 (30 micrograms/L) was added to streams daily for 20 weeks, during which sediments and tiles were sampled biweekly. PW6 had an unexpected stimulatory effect on the abundance and activity (respiration rate) of both sediment and biofilm bacterial communities after the twelfth week, and resulted in decreased biodiversity of the biofilm bacterial communities (as indicated by next-generation sequencing analysis of bacterial 16S rRNA genes). PW6 amendment had no discernable effect on biofilm microscopic algal communities. We hypothesize that the observed stimulatory effect of PW6 was the result of its photocatalysis of complex organic compounds in the system, which lead to increases in labile carbon and nutrient availability.

QUANTIFICATION OF BENTHIC SOURCES AND SINKS OF NITRATE: BUILDING ON AQUATIC EDDY COVARIANCE OXYGEN FLUX

Koopmans, Dirk; Berg, Peter; LaBuhn, Shelby; Klump, Val

101B
Monday, 18 May, 2015 16:45 - 17:00

Our understanding of carbon, nitrogen, and phosphorus transformation in rivers, lakes, and marine systems has been limited in part by the spatial and temporal scales of investigation that our analytical techniques allow. With the aquatic eddy covariance technique (aka eddy correlation), oxygen fluxes are determined at high temporal resolution, under in situ hydrodynamic conditions, and at user-selectable spatial scales. We have used the technique to examine the drivers of oxygen flux over approximately 10 m^2 of cohesive, sandy, and vegetated sediments in a coastal stream and over approximately 10,000 m^2 of cohesive sediments in a hypereutrophic bay. The recent development of precise, in situ, ultraviolet nitrate detection technology has opened the door to the quantification of benthic nitrate fluxes with the same technique. The investigators who developed the technology have proven the technique in a marine setting. This presentation will describe calculated eddy covariance oxygen fluxes in a stream and in a hypereutrophic bay and their implications for future calculation of benthic nitrate fluxes at high temporal resolution, under in situ hydrodynamic conditions, and at user-selectable spatial scales.

THE USE OF CONTINUOUS WATER QUALITY SENSORS FOR ASSESSING TEMPORAL VARIABLITY IN LARGE-SCALE SYNOPTIC STUDIES

Munn, Mark; Konrad, Christopher; Miller, Matthew

103DE
Monday, 18 May, 2015 16:45 - 17:00

Regional approaches for assessing the effects of nutrient enrichment on stream ecosystems often rely on discrete samples at a site; however, nutrients and biological responses can vary rapidly over time. Understanding temporal variability of these measures provides important context to representativeness of discrete data. This study used a combination of six continuous water quality sites nested within a network of 100 discrete-sample sites in the Upper Midwest. Average nitrate concentrations from one agricultural stream were 2.3 mg/L for both discrete (n=8) and continuous (n=5471) data; however, individual discrete values varied greatly and required at least six samples before average values approximated the average continuous values. Benthic chlorophyll at this site varied greatly (50 to 118 mg/m2) due to higher than normal streamflow events, and showed little temporal pattern. During stable streamflow periods, dissolved oxygen concentrations showed increasing diel swings over time, with the diel variation dampened after high flow events. These continuous data demonstrate the need for multiple discrete samples to reduce uncertainty and for targeted efforts during periods of particular interest.

THE IMPACTS OF REDUCED STREAM FLOW ON FOOD WEBS IN STREAMS ON THE ISLAND OF HAWAII

Riney, Michael; Yak, Charlie; Ostertag, Rebecca; Tingley, Ralph; Frauendorf, Therese C.

102DE
Monday, 18 May, 2015 16:45 - 17:00

Stream flow in Hawaii and throughout the tropics is currently threatened by reduced precipitation due to climate change. However, little is known of how aquatic macroinvertebrates are responding to these changes. Decreased stream flow can reduce body condition and reproductive output of native ‘opae shrimp (Atyoida bisulcata) in streams on Hawaii Island, but the underlying mechanisms leading to these changes have yet to be identified. I am comparing the diets of three different aquatic macroinvertebrates in five streams along a rainfall gradient (3000-7000 mm/year) on the North Hilo Coast of Hawai’i Island. Stable isotope signatures (?13C and ?15N) from consumers and dominant food resources are used to solve mixing models that are used to compare consumer diets between streams. Carbon/nitrogen (C:N) ratios of the food resources are weighted with their individual annual biomasses (g/m2) and then averaged to demonstrate if and how relative abundances and quality of food resources differ across the stream flow gradient, and whether the diets of the consumers reflect a response to these potential differences.

ABIOTIC EFFECTS ON SPATIAL DISTRIBUTION AND ABUNDANCE OF TWO HIGHLY HIGHLY INVASIVE SPECIES IN A NOVEL LAKE ECOSYSTEM

Marzolf, Nicholas; Shivers, Stephen; Covich, Alan; Golladay, Stephen

101A
Monday, 18 May, 2015 16:45 - 17:00

The prevalence, spread and impact of invasive species are magnified and unpredictable in novel ecosystems. In Lake Seminole, a reservoir at the confluence of the Chattahoochee and Flint Rivers in southwestern Georgia, the distribution of two highly invasive species, Hydrilla verticillata and Pomacea maculata, are anticipated to alter biogeochemical processes. Mapping of native and non-native submerged aquatic vegetation has documented responses to drought and subsequent hydrologic recovery. H. verticillata is now a dominant macrophyte species in terms of lake surface cover during the growing season in drought years. Its seasonal growth is likely delayed by turbidity associated with spring runoff. P. maculata, more recently introduced, has shown range expansion but may be limited by physiochemical properties, including temperature and calcium. Pomacea expansion throughout the lake may occur as a result of warming water temperatures. Macrophyte dominance may shift as a result of P. maculata grazing, altering the trophic state, and function, of the lake.

INVESTIGATING FINE PARTICLE TRANSPORT AND SUBSTRATE HETEROGENEITY USING THE NOTRE DAME LINKED EXPERIMENTAL ECOSYSTEM FACILITY (ND-LEEF)

Shogren, Arial; Tank, Jennifer L.; Mueller, Joseph; Jerde, Christopher; Bolster, Diogo

103AB
Monday, 18 May, 2015 16:45 - 17:00

Transport and retention of fine particles in streams represents a critical link between upstream to downstream systems, especially in headwaters where particles play a significant role in organic-matter budgets and processing. However, the influence of benthic substrate on particle retention has not been well documented, likely due to inherent heterogeneity of natural systems. To improve understanding, we conducted experimental releases and modeled the impact of benthic substrate heterogeneity and particle size on transport and retention in streams using yeast cells (5um) and corn-pollen (70um). Using the pulse addition technique, we estimated transport distances in four 50m experimental streams (discharge=2L/sec) with varying substrate size (1cm pea-gravel vs. 10cm small cobble) and complexity (homogenous 50/50 mix vs. alternating sections) at ND-LEEF. Transport distances (Sw) ranged from 4-19m for yeast, and 8-41m for pollen under similar flow. Benthic substrate complexity influenced particle retention: particles traveled furthest in cobble, moderate distances in mixed and alternating, and shortest in pea-gravel reaches. Differential retention of particles confirms that the linkage between particulate organic-matter dynamics in flowing waters is not necessarily constant along a spatial continuum.

LAKES TO LANDSCAPES, FISHERIES TO PHOSPHORUS, AND ASSEMBLAGES TO ASSESSMENTS: A 40-YEAR JOURNEY THROUGH (MOSTLY) RUNNING WATERS

Allan, David

103C
Monday, 18 May, 2015 17:00 - 17:15

From the early years of my PhD studies of pond zooplankton to my involvement in Great Lakes work today spans a little more than 45 years, indeed spent mostly in running waters. Heading into the (mostly) retired phase of life seems warranted! Along the way I've worked in a variety of aquatic ecosystems, on issues that span the spectrum from basic to applied, and engaged with various research teams, environmental groups and government agencies. The challenge of unanswered questions and unresolved societal problems, and the colleagues one learns with and from, make the journey rewarding. Occasionally making a useful contribution helps too, but it seems to me that almost all meaningful advances are the work of many. Words cannot express my delight at this opportunity to unite with friends, colleagues, former students and post-docs, and others in reflecting on a meandering career. I am deeply touched and honored.

SPATIOTEMPORAL VARIATION IN ECOSYSTEM HETEROTROPHY IN CARBONATE SUBTROPICAL WETLANDS IS DRIVEN BY FLOCCULENT ORGANIC MATTER

Kominoski, John; Brock, Jim; McVoy, Christopher

103AB
Monday, 18 May, 2015 17:00 - 17:15

Variation in carbon (C) quantity and quality drive processes affecting ecosystem trophic state (net autotrophy or heterotrophy). Labile flocculent organic matter (floc) derived from algae and detritus is an abundant C source in carbonate subtropical wetlands, but the spatiotemporal patterns of floc and its effects on ecosystem trophic state are poorly quantified. We estimated net aquatic ecosystem productivity (NAP) during wet and dry seasons from continuous measurements of depth-integrated water column dissolved oxygen (mg O2 m-2 d-1) and floc metabolism (gross primary productivity, GPP; ecosystem respiration, ER; mg O2 g AFDM-1 h-1) in ridge and slough wetlands in the Florida Everglades. Estimates of NAP were modeled from light, temperature, and reaeration (derived from wind speed). Wet-season NAP was 3× greater (-71.0 ± 22.2 > -213.5 ± 103.1) and dry-season NAP was 1.5× greater (-75.7 ± 13.9 > -113.9 ± 60.2) in ridges than sloughs. Temperature-corrected, floc-derived GPP (11.50 ± 0.28, 11.02 ± 0.38) and ER (25.22 ± 0.27, 25.70 ± 0.26) were similar in ridge and slough. Enhanced ecosystem heterotrophy likely occurs through biogeochemical priming with increased dry-season floc densities.

WHY ARE THE GREAT LAKES FAILING TO THRIVE?

Creed, Irena F.

Ballroom ABC
Tuesday, 19 May, 2015 09:15 - 10:00

For over a century, governments on both sides of the Canada-U.S. border have employed various policy instruments and management tools to protect the Great Lakes. Yet this critical freshwater resource continues to show signs of impaired ecosystem health. The Great Lakes Futures Project (GLFP) is a grassroots project that engaged over 100 stakeholders from Canada and the U.S. to suggest areas of governance reform to achieve a sustainable basin using future scenario analysis. Participants created stories considering the following questions: What forces are driving changes? What are the key uncertainties associated with these drivers? How could these forces change the future from its current path? And if the future unfolds as described in the scenarios, then what would we do about it? A consensus emerged that a breakdown is occurring in the policy regime governing the Great Lakes basin which is leading us towards an undesirable “out of control” future. Members of the GLFP recognize the need for scientists and managers to work within existing governance structures to improve the effectiveness and efficiency of management measures. They propose adaptation of an International Organization of Standardization (ISO) risk management standard developed by industry to reduce risk of engineering failures to show how governments can reduce the risk of ecosystem failures. Specifically, they propose a “bowtie analysis” of human activities that drive ecosystem pressures-effects-impacts to link causal pathways to both hard controls (structures based on design criteria set by science and engineering) and soft controls (strategies based on enabling, facilitating, and tracking activities). This will allow governments to shed light on why, despite best intentions, management systems are not working, and enable governments to continually improve the management system until the risk of policy failures are reduced to acceptable levels, bringing new hope to the future of the Great Lakes.

FLOWING INTO THE FUTURE: APPROACHES AND PERSPECTIVES TO GUIDE FLOW MANAGEMENT FOR SOCIETY AND THE ENVIRONMENT

Orlofske, Jessica; Monk, Wendy

102D
Tuesday, 19 May, 2015 10:30 - 10:45

As we consider the future of flow management, current and historic environmental degradation coupled with society's demands create issues that are real and vast. However, we demonstrate, in part through this session, that a multi-scale, interdisciplinary approach to research and management has tangible benefits and long-term value for the conservation of species and habitats. Three themes emerge from this session and recent contributions to the subdisciplines of ecohydraulics and ecohydrology. The first theme is partnership as an increase in collaborative, interdisciplinary research on all facets of the biological and hydrological continuum contributes to models and environmental solutions. Second, is the reemphasis on individual life histories and organismal properties as the organisms we investigate possess dual roles as both targets of conservation and an effective means to assess the condition of their habitat. Thirdly, new technological and analytical tools enable researchers and managers to collect higher resolution data more quickly and efficiently than ever before. Here, we attempt to synthesize the contributions of this session and emphasize the benefits of these themes for building a stronger freshwater future.

FROM THE HILLSLOPE TO THE STREAM: RAPID TRANSFORMATION OF DISSOLVED ORGANIC MATTER QUALITY IN HEADWATER REACHES OF A MOUNTAIN CATCHMENT

McKnight, Diane; Gabor, Rachel; Burns, Margaret ; Barnard, Holly

101B
Tuesday, 19 May, 2015 10:30 - 10:45

Dissolved organic matter (DOM) transport is a key biogeochemical process in headwater catchments. Studies evaluating DOM mobility have indicated that transformations reflect both sorption and microbial uptake. We studied these processes in a semi-arid montane catchment as part of the Boulder Creek Critical Zone observatory. During low flow, we conducted two tracer experiments by injecting water soluble soil organic matter into a headwater stream reach. Downstream changes in DOM quality were followed based on fluorescence spectroscopy. The results indicated rapid transformation and removal of some soil humic fluorophores within the hyporheic zone. During the high-flow, snowmelt period, we monitored DOM quality on a daily basis within the shallow soil (10 – 25 cm depth) and the stream and compared the results to bi-monthly groundwater samples. In the stream, a pronounced transition occurred from fluorescent DOM being dominated by protein-like material to being dominated by more humic-like material. The FDOM in the soil interstitial water and the groundwater did not change in character. These results indicate that hyporheic processes and shifts in hydrologic connectivity are both major controls on DOM quality.

FACTORS REGULATING INTERANNUAL VARIABILITY OF CLADOPHORA ABUNDANCE IN LAKE MICHIGAN

Bootsma, Harvey; Driscoll, Zac; Turschak, Benjamin; Wilcox, Erin

103AB
Tuesday, 19 May, 2015 10:30 - 10:45

Excess Cladophora growth is a significant management problem on several of the Laurentian Great Lakes. As such, there is a need to understand the mechanisms that regulate it growth. A time series of Cladophora biomass at a nearshore site in Lake Michigan reveals significant interannual variability, with mid-summer peak biomass ranging from 45 to 268 grams dry weight per square meter. We used this data set, along with other meteorological and in-lake variables, to explore the factors regulating Cladophora biomass. Application of a Cladophora growth model suggests that the proximal regulators of Cladophora production are dissolved P concentration and light, with the relative importance of each of these varying among years. An empirical multiple regression model was developed that predicts summer peak biomass based on surface irradiance and surface temperature in May. Potential mechanisms responsible for this relationship are discussed.

TWO METHODS TO ESTIMATE THE IMPORTANCE OF RIVER MANAGEMENT CRITERIA IN A MULTI-CRITERIA DECISION ANALYSIS

Martin, David; Poff, LeRoy; Powell, Sue; Webb, Angus; Nichols, Susan

102E
Tuesday, 19 May, 2015 10:30 - 10:45

Human-driven alterations to freshwater ecosystems are causing the global decline of important drivers of river health. Modern strategies for decision support aim to integrate ecology-based and socioeconomic criteria to balance management decisions. We present two methods to embed a social preference structure for river management criteria into methods for multi-criteria decision analysis. First, we used direct preference elicitation from stakeholders and the analytic hierarchy process to estimate the importance of ecological, recreation, and policy criteria in the Yampa-White River basin in Colorado. This study informs environmental flow planning. A second method was developed on a water allocation planning project in the Goulburn River catchment, Victoria, Australia. Multidimensional scaling ordination was used to objectively partition a large number of feasible water allocation projects into groups that represent logical tradeoffs between the conflicting irrigation and hydro-ecological criteria. This method complements subjective elicitation procedures for estimating the importance of river management criteria. The two case studies offer important approaches to multi-disciplinary decision support analyses around the world.

UNDERSTANDING AGRICULTURAL LAND USE DISTURBANCE THROUGH A SERIES OF MODELS: LANDSCAPE TO WATER QUALITY TO INVERTEBRATES.

Waite, Ian; Schmidt, Travis; Munn, Mark; VanMetre, Pete

103C
Tuesday, 19 May, 2015 10:30 - 10:45

In 2013, the U.S. Geological Survey and the U.S. Environmental Protection Agency sampled 100 streams across 11 States in the Midwest corn belt of the U.S. The ecological condition of streams were assessed in relation to flow, suspended sediment, nutrients, major ions and 230 dissolved pesticides and degradates collected weekly for 12 weeks prior to habitat and algae, invertebrate, and fish community sampling. The effects of various stressor metrics and time windows on macroinvertebrates assemblage metrics were assessed using response models developed for various hierarchical pathways: land use to the stressors, stressors to ecological condition, and then combining results from all models to highlight causal pathways and interactions. Boosted Regression Tree models are compared against alternative modeling techniques for predicting macroinvertebrate metrics across an agricultural disturbance.

OF OLIVES AND CARP: INTERACTIVE EFFECTS OF TWO INVADERS ON LINKED STREAM-RIPARIAN FOOD WEBS

Heinrich, Kaleb; Baxter, Colden

101A
Tuesday, 19 May, 2015 10:30 - 10:45

Multiple invasive species may interact, influencing one another and generating synergistic effects on food webs and ecosystem processes. We investigated the interaction between two nonnative species widespread in the western USA: common carp and Russian olive (RO), an invasive riparian tree associated with di-nitrogen fixation. Deep Creek, Idaho was an International Biological Program site in the early 1970's; at that time carp were rare. Subsequently, RO was introduced and now forms a dense stand, increasing allochthonous inputs and benthic organic matter. Since 1971, carp biomass has increased ~8X (an increase our bioenergetic analysis suggests could not have been sustained by pre-RO resources) and ~67% of gut contents presently consist of olives. A small-scale, short-term experimental removal of these subsidized carp caused ~3X increase in chlorophyll-a concentration, suggesting they may limit algae and macrophyte biomass. However, carp that have consumed nitrogen-rich olives excrete ~4X more N compared to those that have not, which may amplify recycling and export from streams invaded by both species. This scenario is characteristic of an 'invasional meltdown,' with attendant changes in food webs and ecosystem processes.

UNDERSTANDING THE ROLE OF DIRECT CELL-TO-CELL INTERACTION AND MIXOTROPHY IN THE HARMFUL ALGA PRYMNESIUM PARVUM

Laws, Coridon

103DE
Tuesday, 19 May, 2015 10:30 - 10:45

Prymnesium parvum is a harmful alga that causes fish kills and inhibits the growth of competitors through the use of exotoxins. Although the nature of these toxins is not well characterized, these compounds are thought to give P. parvum a competitive advantage with regard to access of limiting nutrients. Recent studies have contradicted the role exotoxins in killing competitors and finfish. Cell-to-cell interaction may play a greater role in the mortality of competitors. Additionally, cell-to-cell interaction may play a role in turning competitors into prey. Using the non-toxic alga Rhodomonas salina as a competitor of P. parvum, I investigated the effects of exotoxicity versus cell-to-cell interaction. Culture plates were set up with permeable membranes, preventing direct cellular contact, but allowing diffusion of exotoxins produced by P. parvum. Results revealed that R. salina was killed when in contact with P. parvum, but persisted when separated from P. parvum by the permeable membrane. Preliminary results also demonstrate that P. parvum nutritionally benefits from the death of R. salina, indicating that mixotrophy may play a role in the proliferation of P. parvum.

EXPERIMENTAL FORESTRY RECLAMATION APPROACH PLOTS SHOW MARKED HYDROCHEMICAL IMPROVEMENT AFTER NINE GROWING SEASONS

Sena, Kenton; Barton, Chris; Angel, Patrick; Agouridis, Carmen; Warner, Richard

102C
Tuesday, 19 May, 2015 10:30 - 10:45

Surface mining for coal has contributed to aquatic ecosystem degradation throughout the Appalachian region, and around the world. Because standard reclamation techniques do not effectively mitigate these impairments, improved reclamation methods have been prioritized for development. The Forestry Reclamation Approach (FRA) has been shown to improve early forest growth on reclaimed mine soils; however, little is known about the effects of FRA reclamation on water quality downstream of mined areas. Research plots were established on a surface mine in eastern Kentucky to assess the impacts of FRA reclamation techniques on water quality. Water quality improved significantly over time after establishment. Electrical conductivity in 2013 was less than half of 2005 values. Sulfates and alkalinity also declined over time after establishment. Our data indicate that FRA reclaimed mine sites may significantly reduce water quality impairment associated with surface mining. Additional studies are required to directly assess water quality effects of FRA plantings at the watershed scale.

AN ASSESSMENT OF BARRIERS TO FISH PASSAGE IN STREAMS AND RIVERS OF THE UPPER MIDWEST U.S. CAUSED BY ROADWAY CULVERTS AND BRIDGES

miller, michael

101CD
Tuesday, 19 May, 2015 10:30 - 10:45

The extent to which roadway culverts and bridges fragment streams and rivers is a relatively recent concern and is poorly understood. I used a random sample of 100 roadway crossings of perennial streams and rivers in the Driftless Area ecoregion to estimate the frequency of occurrence of various barrier types and total number of stream crossing structures in the region that were barriers to fish passage. Study findings indicate 8% of all crossings in the Driftless Area were complete barriers to fish passage, 25% of crossings were barriers to species and sizes of fish with lower sustained swim speeds or that avoid or cannot swim in water < 6 cm deep, 23% of the crossings were temporary water velocity barriers occurring during high stream flows, and 44% of the crossings were not barriers to fish passage. Using crossing structures that simulate natural stream beds or have open bottoms that expose stream bed substrates and that are of sufficient size to accommodate bankfull stream flow volumes would significantly reduce the occurrence of fish passage barriers in the Driftless Area ecoregion.

QUANTIFYING ECOLOGICAL TRAITS TO PREDICT SPECIES, COMMUNITY AND ECOSYSTEM RESPONSES TO CHANGING ENVIRONMENTS

Jähnig, Sonja C.; Poff, LeRoy

102B
Tuesday, 19 May, 2015 10:30 - 10:45

The interrelationships of the environment, biodiversity and ecosystem functioning, is an important ecological principle with special relevance to both estimating global change impacts and guiding aquatic management and conservation. Ecosystem functioning is closely related to the distribution of traits that organisms possess, which reflect ecological characteristics of species, communities, or ecosystems. These traits may be a general characteristic of species or drive ecological processes (effects traits), or they may reflect a preference or sensitivity to change related to varying environmental conditions (response traits). We will give recent examples of developments in quantifying ecological traits and the use to predict species, community and ecosystem responses to changing environments, e.g. new (empirical) methods to derive environmental preferences or sensitivities, the use of traits in ecological prediction frameworks and incorporating trait information into ecological management or conservation approaches.

RESPONSES OF RIVERINE MACROINVERTEBRATE COMMUNITIES TO ANTHROPOGENIC DISTURBANCE: IMPLICATIONS FOR BIOASSESSMENTS AND TRAITS-BASED MONITORING

Yetter, Susan

102B
Tuesday, 19 May, 2015 10:45 - 11:00

Although seeps, pools and channels in riverine corridors rarely provide permanent habitat, annual predictability has enabled many organisms to thrive in these areas. Dependence on stable groundwater, precipitation and temperature regimes makes these habitats vulnerable to both climatic and land use changes. Moreover, little is known about the communities adapted to these habitats, their responses to disturbance, and the importance of connectivity to other aquatic areas. We collected benthic macroinvertebrates in Pennsylvania headwater and floodplain complexes characterized by a mix of aquatic habitats and spanning an anthropogenic disturbance gradient. Using multivariate procedures, we identified community responses in flow pulse and floodplain/wetland habitats across this gradient and developed a Riverine Wetland Invertebrate Community Index. As forested systems shifted to more agricultural and urban settings with increasing hydrologic modification, sedimentation, and erosion, the extent and diversity of these habitats were reduced to instream habitats and disconnected permanent or ephemeral pools. The corresponding macroinvertebrate response was a shift from a diversity of EPT taxa with life history or behavioral traits to a dominance of semi-terrestrial and non-insect taxa with desiccation tolerance.

DOWNSTREAM EFFECTS OF ABRUPT RIPARIAN CHANGES IN STREAMS IN THE ATLANTIC RAINFOREST OF BRAZIL

Feijó de Lima, Rafael; F. Silva-Júnior, Eduardo; Kleba Lisboa, Leonardo; Heatherly, Thomas; Tromboni, Flavia; Zandona, Eugenia; Moulton, Timothy; Thomas, Steven

102C
Tuesday, 19 May, 2015 10:45 - 11:00

Deforestation due to agriculture creates a mosaic of riparian patches along stream corridors. This study hypothesizes that as streams traverse boundaries between these elements, canopy cover, flow and material transport interact to create longitudinal patterns in stream conditions below riparian transitions. We sampled four Atlantic Rainforest streams that traversed discrete forest and pasture riparian conditions. In two streams, we also conducted high intensity spatial sampling through a single forest-pasture transition. We used general linear models (landscape analysis) and nonlinear regression (intensive sampling sites) to quantify the penetration of upstream riparian patches into downstream reaches. We observed significant downstream effects of forest patches on downstream reaches at both tiers of spatial sampling (e.g. shading, nutrient concentrations, chlorophyll a, autotrophic index and CPOM stocks). These results have implications for how streams change as they pass through different riparian conditions that characterize contemporary landscapes.

SOMETHING OLD, SOMETHING NEW, SOMETHING BORROWED… BRINGING TOGETHER DIVERSE METHODS TO QUANTIFY FLOW-RESPONSE RELATIONSHIPS FOR ENVIRONMENTAL FLOW MANAGEMENT

Webb, Angus; Stewardson, Michael; Miller, Kim; de Little, Siobhan

102D

Tuesday, 19 May, 2015 10:45 - 11:00

Despite decades of research using traditional techniques in stream ecology, we still have little ability to make specific predictions of the ecological benefits of environmental flows. Adapting methods developed in other fields of research, we developed new approaches to synthesizing literature (systematic review), capturing expert knowledge (expert elicitation), and statistical modelling of data (hierarchical Bayesian analysis). We used these methods to predict ecological responses to changing flow regimes, here presenting an example for bankside vegetation. This approach allowed us to make best use of all the information that could be brought to bear on the problem of quantifying flow-response relationships. Specifically, we were able to demonstrate that each component improves our ability to predict responses to future flow regimes. Our work demonstrates the potential of using novel tools and information sources to develop predictive flow-ecology models. Nevertheless, some of the resulting predictions have large uncertainties. The freshwater science community needs to continue to develop new approaches for combing theory and data, including drawing on methods from other disciplines, if it is to improve the predictive capacity of flow-ecology models.

FROM THE HILLSLOPE TO THE STREAM: RAPID TRANSFORMATION OF DISSOLVED ORGANIC MATTER QUALITY IN HEADWATER REACHES OF A MOUNTAIN CATCHMENT

McKnight, Diane; Gabor, Rachel; Burns, Margaret ; Barnard, Holly

101B
Tuesday, 19 May, 2015 10:45 - 11:00

Dissolved organic matter (DOM) transport is a key biogeochemical process in headwater catchments. Studies evaluating DOM mobility have indicated that transformations reflect both sorption and microbial uptake. We studied these processes in a semi-arid montane catchment as part of the Boulder Creek Critical Zone observatory. During low flow, we conducted two tracer experiments by injecting water soluble soil organic matter into a headwater stream reach. Downstream changes in DOM quality were followed based on fluorescence spectroscopy. The results indicated rapid transformation and removal of some soil humic fluorophores within the hyporheic zone. During the high-flow, snowmelt period, we monitored DOM quality on a daily basis within the shallow soil (10 – 25 cm depth) and the stream and compared the results to bi-monthly groundwater samples. In the stream, a pronounced transition occurred from fluorescent DOM being dominated by protein-like material to being dominated by more humic-like material. The FDOM in the soil interstitial water and the groundwater did not change in character. These results indicate that hyporheic processes and shifts in hydrologic connectivity are both major controls on DOM quality.

INCORPORATING MANAGEMENT RISK AND VALUES INTO NATURAL RESOURCE MONITORING DESIGNS

Smith, David; Snyder, Craig D.; Hitt, Nathaniel

102E
Tuesday, 19 May, 2015 10:45 - 11:00

For threshold-dependent decisions, management responds to indications from monitoring data that a resource condition crossed a decision threshold (e.g., reference vs impaired conditions). However, there are risks that monitoring data will indicate incorrectly the true state of nature and either impose undue management costs (Type I error) or fail to protect the resource (Type II error). Risk tolerance for Type I and II errors is not often considered explicitly but can be accounted for when setting thresholds and designing monitoring programs by maximizing expected utility. Expected utility is a function of the relative value placed on possible outcomes of correctly or incorrectly determining resource condition. We present an example of optimizing utility values for freshwater bioassessment using benthic macroinvertebrate community data. We found that Type I error rate <0.10 was optimal only when the prior probability of remaining in reference condition was high (i.e., >0.7). We end by discussing the implications of Type I and II error tolerance on sampling designs for selenium assessment in freshwater fish populations.

RULES OF THUMB FOR PRIORITIZING BARRIER REMOVALS EMERGING FROM COMPREHENSIVE ANALYSIS OF GREAT LAKES TRIBUTARIES

Moody, Allison; Neeson, Thomas; Guyette, Margaret; Diebel, Matthew; Herbert, Matthew; Khoury, Mary; Yacobson, Eugene; Doran, Patrick; Ferris, Michael; O'Hanley, Jesse; McIntyre, Dr. Peter

101CD
Tuesday, 19 May, 2015 10:45 - 11:00

In most river networks, both dams and road crossings fragment habitat and impede fish migrations. Because removing these barriers is a costly process and resources are limited, tools are needed to guide prioritization of potential projects. We developed a mathematical optimization model for barrier removals in the Great Lakes basin and an associated online decision support tool (DST) designed for agency and NGO staff. The prioritization model weighs estimated cost of replacing each dam or culvert against length of upstream channel gained, and finds the portfolio of projects that maximizes habitat gains for a given budget. We parameterized this model using a recently-developed dataset describing the location, passability and estimated removal costs of hundreds of thousands of barriers. Across a broad range of budgets, we identify landscape-based predictors for whether barriers are recommended for removal. These patterns offer useful rules of thumb for decision-making even in regions where mapping and optimization modeling is impractical. We also present our online DST, which allows users to view barrier dataset, process subsets of barriers using the optimization model, and update the database.

A LOCAL-TO-GLOBAL-CHARACTERIZATION OF CYANOTOXINS IN FRESHWATER LAKES

Weirich, Chelsea A.; Miller, Todd

103AB
Tuesday, 19 May, 2015 10:45 - 11:00

Mixtures of cyanobacterial secondary metabolites found in freshwater are important toxicologically for potential human exposures during recreational activities and in drinking water. Our laboratory received over 500 samples for cyanotoxin analysis from lakes in North America, Iceland, Europe and South America. Thirteen cyanopeptides were detected using HPLC-MS/MS. The resulting data characterizes cyanotoxin profiles of 36 lake sites between 2008 and 2013. The goal of these analyses was to compare and contrast the types and concentrations of toxic or bioactive cyanopeptides present in lakes from around the world, with identical laboratory methods. All toxins measured were detected in at least one sample. Anabaenopeptin B, anabaenopeptin F, microcystin-LR, and cyanopeptolin 1041 were most frequently detected with occurrences of 52.53, 29.63, 29.63, and 25.25%, respectively. Cyanopeptolin 1020 was least frequently detected in 4.38% of samples. The highest toxin concentration detected was MC-LR at 974 ?g/L. This study illustrates that cyanotoxin profiles differ despite similarities in lake geography or trophic status. Future work will examine cyanotoxin profiles of these lakes in relation to global land-use patterns and lake characteristics.

DEVELOPMENT AND USE OF A PERCENT MODEL AFFINITY FOR ASSESSMENT OF PUERTO RICO STREAMS

Kurtenbach, James

103C

Tuesday, 19 May, 2015 10:45 - 11:00

Puerto Rico currently lacks a stream monitoring program with direct assessment and reporting on biological conditions. This is partly attributed to a lack of development of biological assessment protocols applicable to Caribbean streams. Measures of macroinvertebrate community composition including percent model affinity (PMA) have been developed and successfully applied in temperate North America. Macroinvertebrate data collected 2006 to 2011 from riffle habitat at 41 reference stream sites, were used to develop a PMA for use on high gradient streams in Puerto Rico. The expected community composition was developed and represented by eight major organism groups. Overall, the PMA showed a moderate to strong response across environmental gradients related to land use, water chemistry, and physical habitat. The PMA was found to be correlated to a multimetric macroinvertebrate index that was recently developed for Puerto Rico streams. Use of the PMA for macroinvertebrate community composition in Puerto Rico would allow for determination of biological conditions without the need for extensive information related to invertebrate taxonomy, functional feeding group classification, and organism pollution sensitivity.

SEASONAL POPULATION DYNAMICS AND PRODUCTION OF THE PREDACIOUS CHLOROPERLID, PLUMIPERLA DIVERSA, IN A MOUNTAIN STREAM.

Griffiths, Ronald

103DE
Tuesday, 19 May, 2015 10:45 - 11:00

The seasonal growth and production of the 0+ and 1+ cohorts of P. diversa were compared to examine any influence of diet, as individuals in the 1+ cohorts were predacious, feeding on at least mayflies, chironomids, ceratopogonids and nematodes. Instantaneous growth rates for both cohorts were higher in the summer than in the autumn, but that of the 0+ cohort (4.4%/d) was almost twice that of the 1+ cohort (2.4%/d). Annual production of the 0+ cohort was similar to that of the 1+ cohort (50-60 mg/m2/year). However summer production of the 0+ cohort was 8x that of the autumn, while summer production of 1+ cohort was similar to that in the autumn. This difference may have resulted from abundance of algal resources in the summer versus the autumn for the 0+ cohort, whereas invertebrate prey resources for the 1+ cohort were similar between seasons.

REMOVAL OF THE INVASIVE SHRUB, LONICERA MAACKII, FROM RIPARIAN FORESTS INFLUENCES HEADWATER STREAM BIOTA AND ECOSYSTEM FUNCTION

McNeish, Rachel E.; Benbow, M. Eric; McEwan, Ryan W.

101A
Tuesday, 19 May, 2015 10:45 - 11:00

We investigated the impacts of the invasive riparian shrub Lonicera maackii (Amur honeysuckle) on nutrient dynamics, organic matter subsidies, and the macroinvertebrate community in a headwater stream. Honeysuckle was removed along a 160m stream reach in August 2010. Autumnal, in-stream leaf litter was assessed over 75d, while macroinvertebrate density and algal biomass was measured for three years and a nutrient limitation study was conducted seasonally. Honeysuckle removal significantly reduced canopy cover, light availability, and nitrogen (all $P < 0.01$) and differentially influenced the timing and abundance of leaf litter genera within the stream. For example, Platanus spp. contributed the most organic matter within the removal reach (35-40%) but was mainly absent in the control reach. Macroinvertebrate density significantly increased one year after invasive removal, and was primarily driven by Simuliium sp. Honeysuckle removal also resulted in in-stream nitrogen limitation ($P < 0.05$). These findings suggest removal of a dominant invasive shrub substantially impacts terrestrial organic matter and nutrient subsidies into headwater streams, influencing the timing and abundance of leaf litter habitat and food resources for aquatic macroinvertebrates.

ENVIRONMENTAL DRIVERS OF TRAIT VARIATION IN DAMSELFLIES

Boersma, Kate; Siepielski, Adam

102B
Tuesday, 19 May, 2015 11:00 - 11:15

Although variability among populations in morphological and life history traits is widely documented, the environmental drivers of this variability and its consequences for species coexistence are less well-understood. Understanding how and why traits vary among and within populations is essential to predict how species will respond to environmental changes. Damselflies in the genus Enallagma (Odonata: Coenagrionidae) exhibit a wide variety of morphological and life history traits throughout their range, making them good model organisms to study the environmental drivers of trait selection. We sampled Enallagma from 24 lakes throughout California, ranging from desert to alpine ecosystems. We calculated growth and mortality rates, and conducted morphometric analyses for each population. We used linear models to determine the relationship between local and regional environmental variables (e.g. temperature, elevation, latitude), phenotypic trait distributions, and estimates of selection. Our analyses reveal that local biotic conditions such as population density and the presence of fish predators are more important predictors of damselfly trait variation than regional environmental factors such as latitude and elevation. Biological interactions may be key drivers of selection in this genus.

PREDICTABILITY OF HYDROLOGIC INDICES: IMPLICATIONS FOR STREAMFLOW REGIME CHARACTERIZATION AND DEVELOPMENT OF REGIONAL ENVIRONMENTAL FLOW STANDARDS

Grantham, Ted; Eng, Ken; Carlisle, Daren; Wolock, David

102D
Tuesday, 19 May, 2015 11:00 - 11:15

Characterizing flow regimes using hydrologic indices is common to river research and stream classification. A vast number of hydrologic indices have been developed to capture key flow characteristics of the hydrograph that vary in ecological relevance and sensitivity to human perturbation. Because the natural flow regime reflects the unique climatic, geologic, and topographic characteristics of its drainage basin, it is logically assumed that hydrologic indices are strongly related to physical basin characteristics. However, relationships between hydrologic indices and basin characteristics have not been systematically examined. We developed random forest statistical models to predict over 1000 hydrologic indices using basin predictor variables at USGS reference gages in the coterminous United States. We found that only 202 hydrologic indices (20%) could be reliably predicted. These findings suggest that many hydrologic indices should not be used for regional stream flow classification and environmental flow assessment purposes.

STREAM ECOSYSTEM RESPONSES TO THE TERRESTRIAL INSECT INVADER, HEMLOCK WOOLLY ADELGID

Diesburg, Kristen M.; Sullivan, S. Mazeika P.

101A
Tuesday, 19 May, 2015 11:00 - 11:15

Eastern hemlock dominates ravine and riparian headwater streams throughout central Appalachia and exerts critical influences on stream ecosystems. The invasive insect pest Hemlock Woolly Adelgid (HWA) can cause complete mortality of hemlocks, with unresolved consequences to stream-riparian food webs. At 21 headwater streams of Virginia, West Virginia, and Ohio, we investigated the influence of HWA invasion on water chemistry, benthic and emergent aquatic insects, and riparian spiders of the families Tetragnathidae and Araneidae. A suite of negative relationships between water-chemistry parameters (TDS, total P, PO_4, NH_4) and hemlock decline appear to underlie shifts in benthic insect abundance, diversity, and the percent of individuals belonging to the EPT orders. Although tetragnathid spider density was positively related to hemlock decline, we found no relationships between emergent insects and hemlock decline. Additional analysis of aquatic insect community composition may further inform these results. While preliminary, our results suggest that hemlock decline due to HWA is associated with in-stream biological and chemical properties, and is likely tied to aquatic-terrestrial energetic fluxes. We expect to enhance these findings using naturally abundant stable isotopes.

EFFECTIVE VISUALIZATIONS OF COMPLEX BIOASSESSMENT INDICES BASED ON PREDICTIVE MODELS

Mazor, Raphael D.; Engeln, Mark; Stein, Eric; Ode, Peter

103C
Tuesday, 19 May, 2015 11:00 - 11:15

Effective visualizations can make complicated assessment indices accessible to general audiences. For example, indices based on predictive models are increasingly common in bioassessment applications because of their ability to set different site-specific benchmarks based on environmentally similar reference sites. However, the complexity of these indices may limit their adoption by audiences that lack training in statistics or stream ecology. The complex mathematics of an assessment tool need not prevent the use of effective tools in watershed management because effective data visualization can make an index more easily interpreted. We present a few visualization methods that transform the outputs of indices based on predictive models (both an O/E and multimetric index) into more easily understood graphics. These visualizations address common questions from data users, such as: Which reference sites are most relevant to my sites? How do expectations at my sites differ? And how close are my sites to meeting their biological expectations? Although our examples are specific for an index developed for California, we think these types of visualizations are broadly applicable to many types of indices.

IMPLICATIONS OF GUPPY PHENOTYPE FOR BIO-CONTROL OF LARVAL MOSQUITOES

Warbanski, Misha; Marques, Piata; Phillip, Dawn; El-Sabaawi, Rana; Frauendorf, Therese C.

103DE
Tuesday, 19 May, 2015 11:00 - 11:15

Guppies (Poecilia reticulata) are frequently introduced to water bodies to control mosquito-borne illnesses. Laboratory studies have demonstrated that guppies can consume large numbers of larval mosquitoes. Our study investigates how intraspecific variability in guppy phenotype affects their importance as a mosquito bio-control. Guppies were collected from stream reaches where they faced either high or low predation pressure. These guppies are phenotypically distinct and have different diets in the wild. Using a blocked mesocosm design to mimic streamside pools, we allowed colonization by larval insects for one month prior to introducing guppies. This provided realistic diet choices and insect abundances. We also kept fish-free controls. After one month in the mesocosms, fish were sacrificed to examine gut contents; and insect larvae were collected, counted, and identified. Several mosquito genera have been identified, but full results are forthcoming. We additionally measured algal biomass and nutrient (NH4) concentrations in the mesocosms, however preliminary results show no difference between treatments and control. Since guppy phenotype responds to the local predator regime, it is an important consideration for bio-control policy.

CHANGES IN N2-FIXING ALGAL SPECIES ASSEMBLAGES ACROSS A STREAM TEMPERATURE GRADIENT: IMPLICATIONS OF WARMING FOR SPECIES COMPOSITION AND ECOSYSTEM FUNCTION

Furey, Paula; Welter, Jill; Sander, Delorianne; Williamson, Tanner; Cross, Wyatt

103AB
Tuesday, 19 May, 2015 11:00 - 11:15

In nitrogen-poor streams in Iceland algal abundance and biomass are dominated by N2-fixing algae (cyanobacteria and diatoms in the Rhopalodiaceae which contain endosymbiotic cyanobacteria) that generally increase concomitantly with N2-fixation rates and stream temperature. Factors that drive distribution patterns of specific species which exhibit both broad and narrow temperature tolerances are not well understood. To determine how temperature influences N2-fixing algal species, we compared algal abundance and species assemblage structure across a gradient of geothermally-heated streams (7-28°C) to those from a streamside-channel experiment sourced by a cold stream and heated (indirectly via heat exchangers placed in geothermal pools) across a similar range of temperatures. Species distributions varied with temperature for both the landscape and artificial channels with several taxa showing similar temperature preferences and tolerance ranges. Warmer temperatures supported Cylindrospermum and Anabaena-like taxa while Nostoc dominated across all temperatures but showed species level variation. Rhopalodiaceae responded to shifts in architecture associated with other algal taxa. When combined with species-specific data on N2-fixation rates, knowledge of species-specific ecology will strengthen predictive models developed for understanding stream function in a warming world.

HG SPECIATION AND PERIPHYTON COMPOSITION MATTER IN HG ACCUMULATION TO PERIPHYTIC COMMUNITIES OF CONTAMINATED RIVER

Slaveykova, Vera; Dranguet, Perrine; Le Faucheur, Séverine ; Cosio, Claudia

101B
Tuesday, 19 May, 2015 11:00 - 11:15

Periphyton is known to play an important role in biogeochemical cycles of nutrients and trace metals such as Hg in freshwaters. Nonetheless, its role in the different processes underlying Hg biogeochemistry cycle is still poorly understood. The present study explores inorganic Hg (IHg) and methymercury (MeHg) speciation, uptake to in-situ grown periphyton and possible linkages with periphyton composition in Olt River (Romania) contaminated by Hg containing effluents from a chloro-alkali production plant. IHg and MeHg contents in water and periphyton were analysed, together with different water quality parameters. Biofilm taxonomic composition was characterized by pyrosequencing. Results showed a decrease of IHg and MeHg concentrations in water and periphyton communities with the distance from the effluent release. IHg in periphyton increased linearly with the concentrations of Hg(OH)2 in water, while enhanced MeHg contents were found in peripyton rich in chlorophyll containing microorganisms. Pyrosequencing analysis revealed the predominance of the phototrophic microorganisms in all sites, followed by bacteria and fungi. The phylum composition was dependent on Hg concentrations in water, with Hg-tolerant phylums predominance in the sites with higher Hg concentrations.

SITE-SPECIFIC BENCHMARKS TO REDUCE UNCERTAINTY DUE TO SPATIAL AND TEMPORAL VARIABILITY OF REFERENCE CONDITIONS IN THE ASSESSMENT AND MANAGEMENT OF BENTHIC COMMUNITIES

Grapentine, Lee

102E
Tuesday, 19 May, 2015 11:00 - 11:15

The assessment and management of benthic invertebrates is often a challenge because communities in even the best available reference sites can vary substantially in space and time, thereby affecting the statistical power of assessments and the range of environmental quality guidelines. Characterization of appropriate reference conditions can include (a) identifying and adjusting for effects of natural or nuisance factors and (b) quantifying temporal variability and including it in assessments and the determination of management guidelines. Strategies for defining benthos reference conditions for three disturbed nearshore areas in northern Lake Superior are described. To partition out nuisance spatial variability habitat conditions, which can account for up to 70% of the variability of community descriptors among reference sites, were used to match a subset of reference sites to each assessment site. Temporal variability of benthic communities, potentially resulting in unstable or moving benchmarks of reference conditions, was examined over 10-12 years and accommodated through the delineation of time trajectories for reference and assessment sites. This allowed not only time-specific comparisons but also indications of trends such as improvement of benthic conditions.

PRIORITIZING BARRIER REMOVALS TO RESTORE NATIVE FISH MIGRATIONS IN GREAT LAKES TRIBUTARIES

Neeson, Thomas; Moody, Allison; Guyette, Margaret; Diebel, Matthew; Herbert, Matthew; Khoury, Mary; Yacobson, Eugene; Doran, Patrick; Ferris, Michael; O'Hanley, Jesse; McIntyre, Dr. Peter

101CD
Tuesday, 19 May, 2015 11:00 - 11:15

Tributaries to the Great Lakes are highly fragmented by dams and road crossings that act as potential barriers to migratory fishes, restricting their access to historical riverine spawning grounds. There is growing investment in removing or modifying barriers to restore native fish migrations and ecosystem function, but these efforts may also increase available habitat for invasive species like sea lampreys. The restoration community lacks a systematic method for comparing these costs and benefits to assess which barrier removal projects would offer the greatest return on investment. To address this problem, we developed a mathematical optimization model to prioritize barriers for removal across the entire Great Lakes basin based on trading off breeding habitat for native versus invasive fishes. We parameterized this model using a recently developed database of hundreds of thousands of barrier locations, passabilities and removal costs. We describe the optimal trade-offs between native migratory fishes and sea lampreys that would accompany numerous barrier removal scenarios. We will discuss the sensitivity of the model to uncertainty in our estimates of the suitability of tributaries for native and invasive species.

TESTING OUR UNDERSTANDING OF BOTTOM UP FOOD WEB INFLUENCES: RIPARIAN HARVEST, INCREASED LIGHT, BUT LIMITED RESPONSES OF PRIMARY PRODUCERS AND MACROINVERTEBRATES

Johnson, Sherri; Ashkenas, Linda; Li, Judy; Argerich, Alba; Sobota, Janel

102C
Tuesday, 19 May, 2015 11:00 - 11:15

When there are reductions in riparian cover, a general hypothesis is that increased light to the stream will lead to changes to standing stocks and community composition of lower trophic levels. In small mountain streams of the Trask River Watershed, coastal Oregon, we are studying effects of whole watershed forest harvest on stream food webs and instream habitat, chemistry and hydrology. Here we focus on direct responses of primary producers and macroinvertebrates to removal or reduction of riparian forests and increases in light and stream temperature. Though canopy gap fraction increased from 10% pre-harvest up to 30% after harvest and stream temperatures increased, standing stocks of epilithon and Chl a did not increase above background levels in harvested sites, nor did benthic organic matter. Macroinvertebrate biomass increased at only one site, and shifts in community composition or chironomid abundance did not occur. Uptake by other grazers, including tailed frogs, did not account for the limited responses. Over the next 2 yrs, we will continue to explore why these stream communities did not appear to respond to riparian changes.

REINTEGRATING THE AUTOTROPHIC BASE OF LAKES: FUNCTIONAL CONSEQUENCES OF CONTRASTING RESPONSES OF PHYTOPLANKTON AND PERIPHYTON COMMUNITY STRUCTURE TO FERTILIZATION

Vadeboncoeur, Yvonne; Rooney, Thomas ; Lodge, David

102B

Tuesday, 19 May, 2015 11:15 - 11:30

Consumers in aquatic ecosystems couple benthic and planktonic food chains with a gusto and ubiquity that the ecologists studying them fail to imitate. Benthic and planktonic microalgae are derived from a common taxonomic pool of protists and cyanobacteria, and are interacting functional guilds that form the autotrophic base of lake food webs. We assessed taxonomic similarity between benthic and planktonic algae over 4 years in 4 lakes, 3 of which were experimentally fertilized. Mean within-lake similarity between benthic and planktonic communities at the division level was 14%. Planktonic communities exhibited high among-lake variability within years and high within-lake variability among years at both the division and genus level. Total planktonic biovolume increased with fertilization. In contrast, benthic communities were co-dominated by diatoms, cyanobacteria and chlorophytes in all lakes in all years. Benthic algal total biovolume and species composition was unrelated to fertilization regime. The temporal stability of the benthic algal community combined with the consistently high contribution of PUFA-rich diatoms to total benthic algal biovolume may help explain the widespread importance of littoral primary production to consumers.

STRIVING FOR A BETTER MODEL TO ASSESS LAKE BIOLOGICAL CONDITION: A COMPARISON OF CART, RANDOM FOREST AND MULTIPLE LINEAR REGRESSION

Liu, Bo; Stevenson, Jan

103C
Tuesday, 19 May, 2015 11:15 - 11:30

Ecological assessments with site-specific models of expected condition can improve assessments by accounting for natural variability at finer spatial scales than regional characterizations of reference condition. We compare ecological assessments using a multimetric index (MMI) and three approaches for calculating site-specific models for expected metric values: conventional multiple linear regression (MLR); classification and regression trees (CART); and random forest regression (RF). We used diatom assemblage data collected during the USEPA National Lakes Assessment in summer 2007 for our comparison. Boxplots of MMI showed both CART and RF models had greater separation power than the MLR model, which was assessed using overlaps between interquartile ranges and medians among reference, moderately disturbed and disturbed sites. The root mean squared error for the predictions of expected metric values at reference sites was slightly greater for CART model (0.33) than with random forest model (0.25). We conclude that CART worked sufficiently well that the trade-off between prediction accuracy and interpretability of CART versus RF models may become the deciding factor on which modeling approach to use.

ASSESSING CONGRUENCY OF POPULATION STRUCTURE AND GENE FLOW BETWEEN FRESHWATER MUSSELS AND THEIR HOSTS: A GENOMIC APPROACH

Murphy, Mason; Price, Steven; Haag, Wendell; Weisrock, David

103DE
Tuesday, 19 May, 2015 11:15 - 11:30

Freshwater mussels exhibit a distinctive lifestyle, using fish or amphibians as hosts for larvae and for dispersal. Although the causes for freshwater mussel declines are numerous, a host requirement for larval development and dispersal has direct conservation impacts, as host mobility can influence gene flow among mussel populations. We review and synthesize the current knowledge on the congruency of population structure and gene flow between mussels and hosts. We find that previous population genetic studies in freshwater mussels have been informative in demonstrating patterns of potential lineage boundaries and population structure across broad geographic scales; however, the standard molecular tools used in these studies (e.g., mitochondrial DNA, microsatellites, etc.) have been limited in their information content for diagnosing patterns at the fine-scale necessary for understanding the interplay mediated by host dispersal. We highlight the utility of next-generation sequencing methods to recover genome-wide patterns of genetic variation in mussels and their hosts. We provide preliminary data on our use of these methods to study genetic diversity in the imperiled salamander mussel (Simpsonaias ambigua) and its host, the mudpuppy (Necturus maculosus).

THE EFFECT OF RANDOM PARAMETER ERRORS ON PREDICTABILITY OF LONG-TERM CHANGE IN FRESHWATER PCO2 CALCULATED FROM THERMODYNAMIC EQUILIBRIA

Golub, Malgorzata; Desai, Ankur R.; Remucal, Christy K.; McKinley, Galen A.; Stanley, Emily

101B
Tuesday, 19 May, 2015 11:15 - 11:30

Most estimates of CO2 evasion from inland waters rely on calculating pCO2 using carbonate equilibria models. Therefore, the quality of input parameters directly influences uncertainty in pCO2 estimates and detection level of pCO2 temporal trends. We used North Temperate Lakes Long Term Ecological Research datasets to quantify random errors in the measurements of pH, alkalinity and dissolved inorganic carbon. Monte Carlo simulations were used to propagate uncertainties into long-term records in parameters and pCO2 calculated from three thermodynamic equilibria models to determine the resultant precision of pCO2 estimates. Random parameter errors were generally below 2% and varied by lake type. Temporal trends in pCO2 differed across lakes and thermodynamic equilibrium model type. Each carbonate equilibrium model showed different sensitivities to random uncertainties and many trends were insignificant. We use model simulations to show the level of pCO2 trend that can be detected for a given precision of input parameters, and the implications for designing a set of acceptable precision criteria. Our results highlight the possible challenges in predicting long-term change in aquatic carbon efflux with existing long-term data.

PRIORITIZING STREAMS FOR PROTECTION AND RESTORATION USING A HOUSE-NEIGHBORHOOD FRAMEWORK: A CASE STUDY IN COOK COUNTY, ILLINOIS

Lambert, Timothy; Hinz Jr., Leon; Cao, Yong

101CD
Tuesday, 19 May, 2015 11:15 - 11:30

Restoration success can be limited by the availability of nearby dispersal sources. Recognizing this, Merovich et al. (2013) proposed a house-neighborhood approach to freshwater stream conservation: For restoration, they prioritized poor-quality stream reaches (“houses”) in good-quality watersheds (“neighborhoods”), and for protection, good-quality stream reaches in poor-quality watersheds. We modified this approach for streams in highly urbanized Cook County, Illinois. Using random forests regression with GIS-derived landscape explanatory variables, we predicted fish species richness ($R2 = 0.30$), mussel species richness ($R2 = 0.49$), and a fish-based index of biotic integrity ($R2 = 0.40$) for all inland stream reaches in the county. We then developed and applied three metrics to rank reaches according to their potential for (1) biodiversity protection, (2) dispersal source protection, and (3) restoration. The latter two metrics acknowledge the conservation importance of distance-dependent dispersal along dendritic stream networks by considering both the quality of a stream reach per se and the quality of its network neighbors. Ranking stream reaches with these metrics can help to identify sites at which conservation actions are likely to deliver the greatest results.

RESPONSES OF AQUATIC INSECTS TO MAJOR IONS ASSOCIATED WITH MOUNTAINTOP REMOVAL AND VALLEY FILL OPERATIONS

Clements, William; Kotalik, Chris

102E
Tuesday, 19 May, 2015 11:15 - 11:30

Salinization of streams and rivers is considered one of the most significant environmental threats to freshwater ecosystems globally. Although laboratory experiments indicate that aquatic insects are relatively salt-tolerant, field studies have shown that some groups, especially mayflies, are absent from high conductivity streams. Based on these field studies, the USEPA recently developed a field-based conductivity benchmark of 300 µS/cm for streams affected by mountaintop removal coal mining. This benchmark has been criticized because other confounding factors (e.g., residential development) may influence responses of aquatic insects. We conducted stream microcosm experiments to measure direct effects of several major ions ($MgSO_4$, $NaHCO_3$, NaCl) on community metabolism, macroinvertebrate drift, community structure and survival. Although results showed considerable variation among endpoints, we observed significant conductivity-response relationships for each major ion tested. Consistent with field studies, mayflies were highly sensitive to major ions and effects were observed at conductivity levels near the proposed EPA benchmark. These results support the hypothesis that major ions are toxic to some macroinvertebrates and that effects on benthic communities in the field are likely when conductivity exceeds this benchmark.

ESTIMATING SALMON ENRICHMENT AND DISTURBANCE ON PERIPHYTON OVER THE COURSE OF A RUN USING COUPLED DIN, PERIPHYTON N, AND CHLOROPHYLL A

Ballantyne, Ford; Rueegg, Janine; Song, Chao; Chaloner, Dominic; Lamberti, Gary

103AB
Tuesday, 19 May, 2015 11:15 - 11:30

Salmon spawners can influence periphyton biomass via nutrient subsidies and physical disturbance to benthos. The net effect of salmon, however, depends on the context, mainly defined by discharge, light regime, and preexisting nutrient availability. Here we present a model for the coupled dynamics of dissolved inorganic nitrogen (DIN), chlorophyll a (chla), and periphyton N content (Nb) in which salmon density influences inorganic DIN concentration positively and chla negatively. We used measurements of PAR, temperature, discharge, chla, DIN and NP (collected daily to weekly) from a stream in southeast Alaska to estimate model parameters. Our formulation and analysis enables us to estimate parameters governing both salmon enrichment and disturbance effects on DIN, chla, and Nb. We performed Monte Carlo simulations of DIN, chla, and NP dynamics in the absence of salmon to quantify the significance of the net salmon effect during the run. Our dynamic model allow us to quantify the effects of salmon over the course of a run, identifying periods when salmon enrichment or disturbance dominate.

MODELING FISH SPECIES RESPONSE TO CHANGES IN WATER AVAILABILITY AND CLIMATE IN THE NORTH CAROLINA PIEDMONT, USA

Kennen, Jonathan; Hain, Ernie; Caldwell, Peter; Nelson, Stacy; Sun, Ge; McNulty, Steve

102D
Tuesday, 19 May, 2015 11:15 - 11:30

Streamflows are essential for maintaining healthy aquatic ecosystems and for supporting human water supply needs. Changes in climate, land and water use practices are altering the availability of water throughout the Southeast US. Understanding the potential impact of these changes on aquatic ecosystems is critical for long-term water management. Boosted regression trees and WaSSI, a rainfall-runoff model, were used to predict the relation between streamflow and fish species richness under plausible scenarios of projected future water withdrawal, climate change, and increases in impervious surfaces. Streamflow variability, monthly discharge, the fraction of flow originating on impervious surfaces, and river basin accounted for 44% of the variability in the training data. On average, fish species richness was predicted to decline significantly with increased withdrawals and impervious surfaces, but only a slight decrease was seen under future climate scenarios. Hot spot analyses identified regions that are predicted to change faster than average. Such findings may help resource agencies and stakeholders develop management strategies that prioritize watersheds vulnerable to altered streamflow and better support the protection and long-term conservation of species of special concern.

MULTIPLE INDICATOR ANALYSIS OF STREAMS THROUGHOUT THE DELAWARE RIVER WATERSHED

Kroll, Stefanie; Horwitz, Richard; Keller, David; Minerovic, Alison ; Jackson, John

102C
Tuesday, 19 May, 2015 11:15 - 11:30

The Delaware River Watershed Initiative is a collaborative program between land conservancies, watershed associations, researchers and other environmental non-profits involved in water resource conservation in the Delaware River Basin and Kirkwood-Cohansey Aquifer. In 2013 -2014 we used quantitative sampling approaches to characterize typical conditions in geographies within the basin and to provide baseline conditions at sites before implementation of restoration and preservation projects. A quantitative sampling approach is essential to showing small changes in these ecosystems over time in response to conservation actions. We analyzed fish, macroinvertebrate and algae assemblages in relation to in-stream habitat, riparian buffer condition and land use-land cover at different scales in order to develop metrics relating the ecosystem as a whole to multiple anthropogenic stressors. We present a subset of taxonomic and functional metrics from the three indicator groups that relate to regional stressors and perform better than any single indicator group on its own.

IS BIGGER ALWAYS BETTER? TADPOLES GROW LARGER AND FASTER, BUT WITH LOWER SURVIVAL WHEN RAISED WITH AN INVASIVE PLANT

Milanovich, Joseph; Barrett, Kyle; Crawford, John

101A
Tuesday, 19 May, 2015 11:15 - 11:30

The quantification of the effects of plant invasion on wildlife has shown strong negative, neutral and even positive influences on biota from particular regions, however, an examination of the impact of plant invasion across several regions is lacking. To address whether plant invasion impacts amphibians and what mechanisms may be contributing to potential impacts, we used aquatic mesocosms to raise anuran larvae (Wood Frog, Lithobates sylvaticus) from two regions of the United States with leaf litter from invasive Purple Loosestrife (Lythrum salicaria), native hardwood trees, and a mixture of both. We examined survival, number of days to metamorphosis, and size at metamorphosis and quantified the influence of plant material quality on anuran fitness. Further, we quantified whether the effects of L. salicaria translated to variation in anuran biomass or standing stock of limiting nutrients. Our results show L. salicaria negatively influenced survival of L. sylvaticus, but decreased time to metamorphosis and increased size of metamorphic individuals in two different regions. Post-metamorphic amphibian size was predicted by quality of L. salicaria plant material compared to native hardwood plant material.

DOES SPECIES MATTER? COMPARING THE EFFECTS OF INTRODUCED AND NATIVE TADPOLES ON AQUATIC ECOSYSTEM FUNCTION

Greene, Robin

101A
Tuesday, 19 May, 2015 11:30 - 11:45

Amercian bullfrogs, Rana catesbeiana, are a concern in much of their introduced range because they compete with and eat native species. However, less is known about how bullfrog tadpoles affect aquatic ecosystem function. In the southwest, bullfrogs are introduced and Woodhouse's toads, Anaxyrus woodhousii, are native. We compared nutrient excretion and egestion, and grazing effects of both tadpole species in the San Pedro River, in Arizona. Then, we conducted a mesocosm experiment to determine how these factors influenced algae biomass, primary production, and dissolved and particulate nutrients. Woodhouse's tadpoles had higher carbon (C), nitrogen (N), and phosphorus (P) egestion rates, but bullfrog tadpoles excreted and egested at a higher N:P ratio. Woodhouse's tadpoles decreased algae biomass through grazing. However, bullfrog grazing and nutrient excretion had a positive affect on primary production. Neither species influenced dissolved nutrients, but both decreased particulate C:P and N:P ratios. This research indicates that introduced bullfrog tadpoles may have different ecosystem effects than native toad tadpoles. Since desert streams are often N-limited, bullfrog introduction could potentially alter this limitation and increase primary production.

DEVELOPING GREAT LAKES BIOINDICATORS OF ENVIRONMENTAL CONDITION AND RECOVERY FROM DEGRADATION WITH REFERENCE TO WATERSHED BASED STRESS

Ciborowski, Jan; Kovalenko, Katya; Host, George; Howe, Robert; Reavie, Euan; Brown, Terry; Brady, Valerie; Danz, Nicholas; Niemi, Gerald; Cai, Meijun; Johnson, Lucinda

103C
Tuesday, 19 May, 2015 11:30 - 11:45

Bioassessment typically entails comparing a test site to the reference defined by characteristics of 'best available' sites and associated biota, and the complementary ‘degraded condition’ (sites whose environmental characteristics are deemed unacceptable (‘most disturbed’) by consensus. We derived taxon-specific bioindicators of reference-degraded conditions at Great Lakes coastal margins (assemblages of birds, aquatic vegetation, fishes, aquatic invertebrates and diatoms). Titan threshold analyses of taxon losses or gains often identified 2 thresholds on a stress gradient. At one, many sensitive species disappeared, suggesting biodiversity loss; at another tolerant taxa increasingly dominated. All assemblages were affected at approximately the same threshold, suggesting significant ecosystem functional alteration at these points. Biological indices can be calibrated to identify these critical points as “biological criteria”. We propose that the non-degraded/degraded threshold be a suitable operational target to define the boundary between impaired and non-impaired conditions needed to delist Beneficial Use Impairments at AOCs. The reference/non-reference threshold may be a suitable operational target to define the boundary between biodiverse and less biodiverse conditions.

UTILIZATION AND ENVIRONMENTAL IMPACT OF ORGANIC CARBON FROM CYANOBACTERIAL BLOOM BIOMASS IN A EUTROPHIC LAKE

Jiang, Helong

101B
Tuesday, 19 May, 2015 11:30 - 11:45

Cyanobacterial blooms frequently occur in eutrophic freshwater lakes, subsequently, substantial amounts of organic carbon are produced. A majority of the algal-derived organic carbon will be utilized by microbial communities in lakes. Bacterial community composition in cyanobacterial phycosphere was highly organized and showed obvious difference from phytoplankton. Furthermore, bacterial communities of different sized aggregates within the cyanobacterial phycosphere varied with dependence on aggregate size. Bacterial species on large and small-size aggregates likely have the ability to degrade high and low molecular weight compounds respectively, possibly operating in sequence and synergy to catalyze the turnover of complex organic matters. In addition, extracellular polymeric substances from bloom-forming cyanobacteria play an important role in the fate of contaminants. After decaying, cyanobacterial bloom biomass settles onto the lake sediments, which led to the occurrence of hypoxia and the release of phosphorus from sediments but improved the degradation of polycyclic aromatic hydrocarbons in sediments. Therefore, organic carbon from cyanobacterial bloom had multi-functions for lake biogeochemistry processes and water environment quality, and thus needs to be considered in the management and remediation of freshwater ecosystems.

DOES SITE-SCALE STREAM RESTORATION MAKE A DIFFERENCE OVER TIME?

Wright, Kristopher

101CD
Tuesday, 19 May, 2015 11:30 - 11:45

Each year time and money are invested to restore historically degraded streams; however, many resource agencies and conservation organizations are unable to dedicate sufficient resources to monitor and evaluate these restoration efforts. Consequently, there are only a limited number of examples that illustrate how restoration practices impact stream habitat and communities over time. This project examined how stream habitat and communities in the upper Blue River, WI responded to Trout Unlimited restoration efforts over an eleven year period. In-stream habitat, macroinvertebrates, and fish were sampled at 11 different sites along the Blue River from 2004-2014. Pre-restoration surveys were compared to post-restoration surveys collected at regular intervals following restoration. Restored sites were also compared to completely unrestored sites located within the same stream section and sampled at the same intervals. Results suggest that stream habitat and communities respond rapidly to restoration and then go through continuous adjustments as time goes on. Not surprisingly, such impacts of restoration are predicated on the continued land-use management.

SPATIAL AND TEMPORAL VARIATION IN STREAM SEDIMENT MICROBIAL COMMUNITIES IN AN URBAN COASTAL NORTHEASTERN WATERSHED

Henderson, Nicole; Christian, Alan ; Burke, Deirdre

102C
Tuesday, 19 May, 2015 11:30 - 11:45

Global change drivers such as land use land cover (LULC) change have major impacts on water quality in watersheds. Meanwhile, other regional and local factors can also influence water quality. The goal of this study was to assess sub-watershed LULC and other regional and local parameters influence on microbial functional group communities in the Neponset River Watershed, Massachusetts. The 5 major watershed LULC are forested, industrial, residential, wetlands, and golf courses. We hypothesized that there will be both temporal (seasonal) and spatial (LULC) differences in the microbial communities. Seasonally, sediments and other environmental variables were collected and analyzed at 14 stations. Fatty acid methyl esters (FAMES) were used to characterize the microbial communities, and PCA was used to analyze the FAMES and environmental variables. While LULC appears to influence microbial communities, local environmental conditions, including physical habitat, also play a role in structuring microbial communities. These results help to show the link between microbial community structure, LULU, and other regional and local parameters and will aid in the efforts of encouraging best management practices in the watershed.

HISTORICAL CHANGE IN POPULATION CONNECTIVITY OF THE NINESPINE STICKLEBACK IN AN AGRICULTURAL LANDSCAPE

Ishiyama, Nobuo; Sueyoshi, Masanao; Nakamura, Futoshi

103DE
Tuesday, 19 May, 2015 11:30 - 11:45

Population connectivity of aquatic organisms has been historically altered by agricultural developments. Understanding the limits and the potential of the altered connectivity would be valuable for conservation planning. In modern wetland systems, artificial watercourse networks, such as agricultural ditches, maintain population connectivity as an alternative to river flooding. Here, we compared the historical and contemporary gene flow of wetland fish Pungitius pungitius using Bayesian approaches. The populations were divided into four genetically different clusters along the Tokachi river, Japan. We found that the contemporary gene flow was restricted to occurring only between neighbouring clusters, although widespread gene flow had been detected historically. Furthermore, we consistently found the same potential-source cluster from the past to the present, which is characterised by large amounts of remnant habitats connected by artificial watercourses. These findings highlight that (i) artificial connectivity can sustain short-distance migrations of wetland fish, which contribute to maintaining the potential source populations; however, (ii) migration over an entire landscape, which ensures longer species persistence, has been prevented by agricultural developments.

AN ANALYSIS OF REPLICATE MACROINVERTEBRATE SAMPLES TO ASSESS UNCERTAINTY IN MEASURES OF TAXON ABSENCE IN WEST VIRGINIA STREAMS

Roark, Shaun; Lynch, Jeniffer; DeJong, Grant; Kovach, Amanda; Gensemer, Robert; Canton, Steve

102E
Tuesday, 19 May, 2015 11:30 - 11:45

Recently, field-collected data from paired macroinvertebrate and water quality surveys have been used to establish thresholds for parameters such as nutrients, sediments, and conductivity. This use differs from the use for which they were collected. If field-collected data are to be used to establish water quality thresholds, consideration must be given to study design, data usability, and quantification of the uncertainty of measures (e.g., absence of taxa) that will be used to determine effects. To assess the reliability of absence determined with 200- and 300-count samples, we analyzed macroinvertebrate data from sites on three West Virginia streams with five replicate samples per site. These results corroborate our previous analyses, and indicate that absence determination at a site based on a single fixed-count subsample has significant uncertainty. We conclude that unintended bias resulting from a suboptimal sampling design may lead to bias in field-based water quality thresholds, and that a robust data quality objective process should be used when collecting new data or making use of existing data from biomonitoring programs to avoid erroneous conclusions and unintentionally biased water quality thresholds.

TRAIT CHARACTERISTICS AS DETERMINANTS OF METAL EXPOSURE AND UPTAKE IN STREAM INVERTEBRATES

Short, Terry; Hornberger, Michelle

102B
Tuesday, 19 May, 2015 11:30 - 11:45

Relations between whole-body metal concentrations and species traits were examined for 40 invertebrate taxa in a mining-impacted river to determine 1) the extent to which trait-based characteristics accounted for species-specific differences in metal exposure and uptake, and 2) which traits were most effective in identifying exposure pathways and predicting uptake potential. Traits related to developmental strategies (e.g., generations per year) and habitat use (e.g., fluvial and substrate preferences) generally were poor predictors of metal bioaccumulation. In contrast, metal uptake was positively related to chemical and physical stressor tolerances. Comparison of feeding trait affinities and metal bioaccumulation patterns showed that feeding behavior was the strongest predictor of metal uptake among the traits examined. Metal concentrations increased in taxa relying on filtering or gathering as part (>40%) of their food acquisition strategy. Concentrations decreased where predation assumed a greater proportion of overall feeding activity. Application of trait characteristics as predictive tools may help identify taxon or taxa groups that may be at greatest risk in metal-disturbed environments.

AN ASSEMBLAGE-LEVEL TRAIT MODEL PREDICTS POPULATION-LEVEL LIFE HISTORY VARIATION AND RESPONSE TO FLOW REGIME IN THREE STREAM FISHES

Bennett, Micah; Whiles, Matt; Whitledge, Gregory

102D
Tuesday, 19 May, 2015 11:30 - 11:45

Trait-based approaches could generate a mechanistic understanding of community assembly. However, such approaches generally assume that trait-environment relationships are consistent across space and time, and that interspecific variation exceeds population-level variation. There is little information on these assumptions available for most groups, and thus assessing population-level trait-environment relationships could test the generality of trait-based models while evaluating intraspecific variation. We evaluated the generality of the trilateral life history model (TLHM) for fishes - well-studied at the assemblage level - to populations of three stream fishes in the midwestern US. The TLHM adequately described the major trade-offs in traits among populations in all three species, but the flow-based predictions of the TLHM were only well-supported in one species. Intraspecific trait variability was of similar magnitude or higher for some traits compared to interspecific ranges. Such high variability could affect studies that assign mean trait values to species. This, coupled with the explanatory power of the TLHM at the population level, suggests that a synthesis of environmental filtering or habitat template models with modern life history theory could be valuable.

SPECIES RICHNESS OF DIATOMS AND SOFT-BODIED ALGAE IN STREAMS WITHIN A LAND-USE MOSAIC IN SOUTHERN NY STATE

Wehr, John; Truhn, Kam; Perrone, Alissa

103AB
Tuesday, 19 May, 2015 11:30 - 11:45

We characterized benthic algal biodiversity in sixty 1st-5th order streams in a mosaic of forest, rural, agricultural, and urban landscapes. Marked differences in diatom richness (urban minima 17-27; forested, rural streams maxima 70-120) and soft-bodied algae corresponded with significant differences in conductance, pH, nutrients, DOC, Ca, and Na among landuse categories. Achnanthidium minutissimum, A. rivulare, Enycyonema minutum, Coccoconeis placentula, Planothidium frequentissimum /lanceolata, and Remeria sinuata persisted year-round in >60% of all sites, while summer-dominant taxa (Gomphonmena parvulum, Navicula minima, Cymbella minuta) were uncommon in spring. Frequencies of common softbodied taxa (Audouinella hermanni, Phormidium autumnale, Chamaesiphon minutus, Stigeoclonium tenue, Homeothrix varians, Ph. retzii, Ulothrix zonata, Cladophora glomerata) exhibited differences among land-use and season. Macroalgal taxa richness ranged from 2 to 13 per site (mean 6.5), with greater richness in autumn-winter vs. spring-summer. Elevated conductance, N and P correlated strongly with landuse and species richness differences. Several cyanobacteria (Capsosira brebissonii, Coleodesmium wrangelii, Cyanodermatium fluminense) and green algae (Gongrosira fluminensis, G. debaryana), infrequently reported in North America, were common in upland NY streams, suggesting they are taxa overlooked in past surveys.

IMPACTS OF NEW ZEALAND MUDSNAILS (POTAMOPYGRUS ANTIPODARUM) ON ECOSYSTEM METABOLISM IN A COLD WATER STREAM IN WISCONSIN, USA.

Shupryt, Michael; Ferry, Maureen

101A
Tuesday, 19 May, 2015 11:45 - 12:00

Aquatic invasive species have colonized freshwater ecosystems across North America impacting structure and function of native systems. New Zealand mud snails (Potamopyrgus antipodarum) were recently discovered in Black Earth Creek, Wisconsin. We used publically available data on dissolved oxygen, temperature, discharge and solar radiation to estimate daily rates of gross primary production (GPP) and ecosystem respiration (ER) at three locations over a continuous four year period. As the first year of data was likely before the P. antipodarum invasion and one of the three sites is upstream of the known invasion, we used a before-after control-impact design to evaluate the impacts of P. antipodarum on GPP and ER. After correcting rates of GPP and ER with daily rates from the control site we found no significant change in GPP and a significant increase in ER of approximately 17 and 9 percent per year at each of the impact sites. Although we cannot causally link P. antipodarum to changes in stream metabolism our results indicate that ER increased, relative to a control site, in Black Earth Creek after invasion.

CLIMACTIC CHANGE IN LAKE MICHIGAN: BIG EVENTS, BASIN-WIDE IMPACT

Cuhel, Russell; Aguilar, Carmen

101B
Tuesday, 19 May, 2015 11:45 - 12:00

Ecosystem engineering of Lake Michigan by benthic bivalve invaders has exceeded any previous event since human settlement. Dreissenids are not the only force acting upon lake metabolism, however, and both meteorological and human manipulation have also exerted outstanding influences on Lake Michigan structure and function. Much like Keeling's Mauna Loa carbon dioxide data, aspects of lake biogeochemistry contain multi-decadally consistent seasonal cycles upon which major trends or alterations are superimposed. In this work, a focus on geological features interacting with hydrodynamics indicate a major role of the Mid-Lake Reef Complex, a multi-seamount-like structure in south central Lake Michigan, in basin- and even lake-wide ecosystem function. Annual oscillations of dissolved silicate suddenly dampened dramatically following Quagga Mussel establishment, accompanied by major increases in water clarity. Meteorological events including the Great Flood of 2008 produced readily-discernable anomalies. All these are signals on a continuous trend of decreasing biomass and dampened nutrient cycles resulting from decades of phosphorus management. The oligotrophicated water column belies a newly organic-rich benthos different from any of the other Great Lakes of North America.

WATER SCARCITY AND FLOW REDUCTION: UNFORESEEN INDUCED ANOXIA AND HYPOXIA EFFECTS ON STREAM INVERTEBRATES

Pardo, Isabel; Garcia, Liliana

102B
Tuesday, 19 May, 2015 11:45 - 12:00

Flow reduction generated by human activities, including climate change and water scarcity, can alter abiotic and biotic properties of stream ecosystems. We tested the response of invertebrates to complete flow suppression by damming longitudinally two small lowland streams. We sampled benthic invertebrates in control, and impact stretches (stagnant and drought) before and after the establishment of the dam during 10 weeks in summer. Oxygen dataloggers were weekly fixed for 24 hours at each control and two impacted stretches simultaneously. Flow reduction caused a sudden decrease in dissolved oxygen values (reaching anoxia and hypoxia) with great daily fluctuation varying with stream and stretch. TITAN invertebrate indicator taxa responded with differential sensitivity to oxygen reduction, some declining already at a minimum of 7.3 mg O_2/l, others at 6.1 mg O_2/l and 4 mg O_2/l. Taxa traits confirmed significant decline in the density of forms respiring with tegument, gills and of those using plastron, while a significant increase for air breathing taxa. Results warn on potential unforeseen anoxia and hypoxia impacting stream invertebrates in the face of water scarcity and associated flow reduction.

THE CONTRIBUTION OF FISH EXCRETION TO NUTRIENT CYCLING IN STREAMS ACROSS A LAND-USE GRADIENT

Barrons, Howard; Reisinger, Alexander J.; Tank, Jennifer L.; Tiegs, Scott

102C
Tuesday, 19 May, 2015 11:45 - 12:00

Human-induced alterations to streams may alter the significance of animal excreta as a nutrient source in stream ecosystems. We quantified whole-stream nitrogen and phosphorus uptake, and fish excretion, in streams draining watersheds with contrasting land use. Background nutrient concentrations were related to land-use; ammonium (NH4+) was higher with urbanization and lower in streams draining forest, and soluble reactive phosphorus (SRP) decreased with agriculture. In contrast, fish abundance and diversity were positively related to benthic sediment size, but not to land use. Species classified as 'intolerant' were negatively correlated with urbanization, and positively correlated with agriculture and forested riparian-zone area; in addition, they also excreted significantly less NH4+ and SRP than 'tolerant' species. Three of the most abundant species (of 18 total) provided 86% of the total excretion across all streams. Relative to reach-scale nutrient uptake, fish excretion contributed 1-55% and 0-11% of areal NH4+ or SRP uptake, respectively, and contributions increased with fish density. Although land-use did not directly influence fish communities, these results show that human alterations to community traits such as pollution tolerance can influence stream ecosystem function.

TEMPORAL DYNAMICS OF TOXIC CYANOBACTERIAL PEPTIDES IN A EUTROPHIC LAKE

Bartlett, Sarah ; Weirich, Chelsea ; Miller, Todd

103AB
Tuesday, 19 May, 2015 11:45 - 12:00

Large accumulations of cyanobacteria threaten the health and sustainability of freshwater ecosystems due to their harmful effects on aquatic biota. Here we provide time series concentrations of cyanobacterial toxins (including four microcystins) and secondary bioactive metabolites (CTSMs) at sub- daily scales in Lake Winnebago, a hypereutrophic environment in Wisconsin that serves as a drinking water resource to four major cities. Thirteen CTSMs were targeted in this study, detected from lyophilized water samples using liquid chromatography - electrospray ionization tandem mass spectrometry. Of the CTSMs targeted, all but two were detected in the lake on at least one date with max combined levels of 30.49 ng/ml. Temporal variability showed that CTSM levels varied by orders of magnitude over the course of hours. We observed that the maximum toxin concentration was most abundant prior to the onset of the bloom event, concomitant with diel cycling of the algal community. As such, toxin concentration was not correlative with either chlorophyll or phycocyanin, but rather with diel cycling. This is the first study to provide an analysis of CTSMs in lakes at sub- daily scales.

RIVER OTTER OCCUPANCY IN ILLINOIS STREAM SYSTEMS AS A FUNCTION OF THE SEMI-AQUATIC MAMMAL COMMUNITY

Holland, Angela; Hellgren, Eric; Nielsen, Clayton; Schauber, Eric

103DE
Tuesday, 19 May, 2015 11:45 - 12:00

River otters play critical roles in freshwater aquatic systems as trophic-transfer agents and apex predators. We modeled multi-season occupancy dynamics of otter and co-occurrence of other semi-aquatic mammal species (beaver, mink, and muskrat) to better understand the riparian community in Illinois. We surveyed for semi-aquatic mammals at 120 bridge sites in Jan-Feb and Mar-Apr for 3 years in 11 major watersheds in southern Illinois (44,526 km2). Each survey unit was a 400-m stream segment visited twice by 2 observers. Sites located within otter reintroduction watersheds had a higher initial probability of occupancy (0.58) than did other watersheds (0.30). The probability of otters colonizing a site increased over the study period and increased from 0.22 to 0.35 when beavers were present. The ability of beavers to change the flow of a stream through the building of dams may create pools ideally suited for otter foraging. Probability of site extinction varied between seasons and decreased in the presence of mink, thus mink may indicate stable prey populations resulting in consistent otter occupancy.

ACCOUNTING FOR TEMPORAL VARIABILITY OF CONDUCTIVITY FOR EFFECTIVE MANAGEMENT OF SALINITY AS A FRESHWATER AQUATIC LIFE STRESSOR

Timpano, Anthony; Schoenholtz, Stephen; Soucek, David; Zipper, Carl

102E
Tuesday, 19 May, 2015 11:45 - 12:00

Salinization is a growing threat to freshwater biota globally, including in Appalachian headwater streams influenced by coal mining in the U.S. In such streams, bioassessment and management of salinization impacts is typically based on seasonal surveys of electrical conductivity (a salinity surrogate) and benthic macroinvertebrates. However, temporal variability of salinity can affect development and application of regulatory endpoints. To quantify and account for such variability, we monitored conductivity continuously and surveyed benthic macroinvertebrates and conductivity seasonally (spring and autumn) over 30 months in 25 headwater streams spanning a gradient of salinity where non-salinity stressors are minimized. We found that conductivity was inconstant, exhibiting a spring minimum and autumn maximum, with frequent transient dilution spikes and recovery. In addition, biological-effect endpoints for conductivity derived using our spring survey data underestimated maximum salinity concentrations to which many invertebrate taxa are likely exposed over the course their life cycles. Here we examine alternative approaches for deriving and applying biological-effect endpoints for conductivity that account for its temporal variability.

THE USE OF BENTHIC INVERTEBRATE TOLERANCE VALUES IN COLORADO'S 2014 SEDIMENT GUIDANCE

Gerlock, Kimberly; Roark, Shaun; Lynch, Jeniffer

101CD
Tuesday, 19 May, 2015 11:45 - 12:00

The State of Colorado formed a technical advisory committee of stakeholders and state personnel to support a revision of its 1998 sediment guidance for implementation of its narrative standard. The new method, finalized in 2014, determines if fine sediments are having a detrimental effect on aquatic life and includes three components related to benthic invertebrates: percent fines as a measure of sediment deposition, overall Tolerance Indicator Value (TIV) calculated for each site based on the inferred sediment tolerance of the macroinvertebrate taxa present, watershed review. TIVs have been widely used in benthic invertebrate bioassessments throughout the United States as generalized indicators of stress; recently the focus has been on designing TIVs that are specific to certain stressors such as fine sediments. Threshold values for the percent fines and overall TIV for a site were developed and specific to three “sediment regions” in Colorado to ensure the range of conditions that occur were addressed. In addition, the new policy includes a separate threshold that assesses the percentage of fines in salmonid spawning habitat to ensure such habitats are protected.

ASSOCIATIONS BETWEEN STREAM HYDROGEOMORPHOLOGY AND FISH ASSEMBLAGES IN AN URBAN LANDSCAPE

Rieck, Leslie O.; Sullivan, S. Mazeika P.

102D
Tuesday, 19 May, 2015 11:45 - 12:00

Urbanization of watersheds can result in considerable changes to stream hydrogeomorphology, including abrupt changes in substrate composition, channel geometry, gradient, and flow characteristics. In this study, we investigated potential influences of urban-induced changes in fluvial geomorphology on fish assemblages in 23 stream reaches of the Columbus Metropolitan Area, OH. Results suggest that a number of hydrogeomorphic factors influenced fish assemblage species richness, diversity, and composition. Channel slope was negatively related to species richness, evenness, and diversity; fish abundance was positively related to channel widening; and the relative abundance of tolerant individuals within the fish assemblage was negatively associated with bankfull flow velocity. At a subset of 12 stream reaches where we monitored coordinated fish-geomorphic changes over four years, we observed that increasing channel entrenchment led to lower assemblage diversity, fewer sensitive darter species, and decreases in the relative abundance of predators. Collectively, these results indicate that hydrogeomorphic variables contribute to the suite of environmental determinants of fish assemblages in urban landscapes and that rapid fluvial geomorphic adjustment can prompt ecologically-meaningful changes in community structure and function.

MAPPING THE BIOLOGICAL CONDITION OF USA RIVERS AND STREAMS

Hill, Ryan; Weber, Marc; Leibowitz, Scott; Olsen, Anthony

103C
Tuesday, 19 May, 2015 11:45 - 12:00

We predicted the probable (pr) biological condition (BC) of ~5.4 million km of stream within the conterminous USA (CONUS). National maps of prBC could provide an important tool for prioritizing monitoring and restoration of streams. The USEPA uses a spatially balanced survey design to estimate the proportion of streams that fail to support healthy BC, but does not infer BC at un-sampled locations. To model BC, we developed a GIS database of >100 anthropogenic and natural watershed metrics for streams within the CONUS. We combined these data with 1,883 USEPA-sampled streams that were previously assessed as having ‘good’ or ‘poor’ BC. prBC was best predicted (70% correctly classified) with random forests using elevation, % riparian naturalness, population density, air temperature, watershed % forest and % agriculture as predictors. National maps of prBC provided a unique assessment of model performance. Specifically, lower prBC was consistent with large-scale patterns of human-related land use. However, local prBC was sometimes unrealistic, suggesting that predictions could be improved with regional, rather than national, models. Models will soon be extended to also include 356,044 lakes.

RECONSIDERING THE PROBLEM OF DIATOM ASSESSMENT OF STREAMS IN AGRICULTURALLY DOMINATED REGIONS

Stevenson, Jan

103C
Tuesday, 19 May, 2015 13:30 - 13:45

Assessment of ecological condition in agriculturally dominated regions has been problematic when using diatom assemblages. Little difference was observed between reference and highly disturbed sites in the USEPA's National Rivers and Streams Assessment (NRSA). Multiple studies show diatoms respond more to nutrients in low than high ranges of nutrient concentrations. In addition, criteria for reference sites are often relaxed for agriculturally dominated ecoregions, which results in greater variation in levels of human disturbance and nutrient concentrations. That variation in the NRSA spanned the range of sensitive diatom response. However, responses of diatoms along the entire nutrient concentration and human disturbance gradients were great. A modeled MMI using land use helped distinguish minimally disturbed and highly disturbed sites. In addition, refined metrics that emphasize taxa responding to intermediate and high concentrations of nutrients improved assessment sensitivities in agriculturally dominated regions. These results indicate that different metrics can be used to aid distinguishing reference and disturbed sites in agriculturally dominated regions, but stricter definitions for reference conditions (which would also allow a consistent national-scale definition of reference condition) would also aid assessment.

CAN A RIVER BE RESTORED AFTER A CENTURY OF DISTURBANCE? LESSONS FROM FOSSIL CREEK

Marks, Jane; Gibson, Cathy ; Adams, Ken; Koch, Ben; Oneill, Matt

101CD
Tuesday, 19 May, 2015 13:30 - 13:45

Fossil Creek was dammed and water diverted for hydropower production for almost a century. Non-native bass and sunfish dominated the fish assemblage. Managers removed non-native fish, returned full flows, and dismantled the diversion dam. Here we demonstrate that multiple attributes the river rebounded when primary threats were reversed. Native fish increased quickly and remained high. Both removal of non-natives and return of flow was essential to fish recovery. Food web structure, measured using stable isotopes, showed that natives replaced non-natives at the top of the food chain. The contribution of algae in fish diets increased concurrent with increases in primary productivity. Primary productivity and nitrogen uptake increased in response to flow and travertine deposition. Populations of non-native crayfish increased immediately following restoration but subsequently declined in most sites. Non-native crayfish appear to be controlled by fish predation and travertine deposition. The primary remaining threat to Fossil Creek is unsustainable and poorly managed recreation. Although designated as a Wild and Scenic River, managers struggle to develop and enforce an adequate management plan.

USING THERMAL TOLERANCE TRAITS TO PREDICT THE RESPONSE OF AQUATIC INSECTS TO WARMING: IS THERE GEOGRAPHIC VARIATION?

Shah, Alisha; Ghalambor, Cameron

102B
Tuesday, 19 May, 2015 13:30 - 13:45

Geographic variation in temperature acts as an ecological filter shaping species membership within communities, and as an evolutionary selection pressure shaping adaptive differences among populations and species. Thus, predicting how populations, species, and communities will respond to warming requires an understanding of the geographic variation in thermal tolerance traits. Tropical environments, characterized by stable climatic regimes, are thought to favor the evolution of narrow thermal tolerances. Conversely, temperate environments with variable thermal regimes should favor broader tolerance. Yet, few studies have examined variation in thermal tolerance patterns between temperate and tropical aquatic systems. We compared phylogenetically related dominant aquatic insect taxa collected from low-to-high-elevation freshwater streams in the Ecuadorian Andes and Colorado Rockies. Thermal tolerance was measured as critical thermal maximum (CTmax) and metabolic rate as a function of temperature (MRT). Our results to date, suggest low elevation and temperate taxa are more tolerant of warmer temperatures compared to their high elevation and tropical counterparts. These results also suggest that the response to warming is likely to vary across elevation and latitude.

DENSITY DEPENDENCE OF HERBIVOROUS FISH IN STREAM MESOCOSMS

Pennock, Casey; Gido, Keith

101A
Tuesday, 19 May, 2015 13:30 - 13:45

Herbivorous fish can have strong effects on stream ecosystem function by consuming primary producers and excreting limiting nutrients. Thus, factors regulating their biomass and abundance might feedback to determine ecosystem function. We tested if populations of Central Stonerollers Campostoma anomalum exhibit density dependence across a range of typical densities found in Great Plains streams. We predicted that stocking density and fish growth would be negatively associated, while primary production and fish growth would show a positive relationship. Central Stonerollers were stocked across a range of densities in eight experimental stream units. Change in mass (production) was measured between the beginning of the experiment and after 41 days. Fish growth was compared to initial stocking biomass and primary production using regression analysis. Average growth of individuals was negatively associated with stocking density (r2=0.61; p=0.02). Contrary to our prediction, fish growth was not related to primary productivity (r2=0.001; p=0.93), thus density dependence occurred despite no apparent lack of food resources. We hypothesize that stoneroller growth was limited by competition for high quality algae or invertebrates, or behavioral interactions causing interference competition.

NOT ALL SCIENTIFIC UNCERTAINTIES ARE CREATED EQUAL FOR LANDSCAPE SCALE HEADWATER STREAM MANAGEMENT

Katz, Rachel; Campbell-Grant, Evan; Runge, Mike; Hocking, Daniel; Letcher, Ben; Roy, Allison

102E
Tuesday, 19 May, 2015 13:30 - 13:45

Management decisions related to stream conservation are inevitably made under a range of scientific uncertainties. Reducing these uncertainties could influence management strategies, but there is a trade-off between devoting resources (time and money) to management actions and devoting resources to research to gain knowledge to improve management outcomes. Although the importance of reducing uncertainty depends on the decision context (e.g., management goals and threats), specific management uncertainties rarely motivate headwater stream research explicitly. We use value-of-information analysis to explore research-management trade-offs by quantifying how much headwater stream management outcomes could be improved if new information was gained (i.e., scientific uncertainties were reduced). We use the decision context and management framework from two northeastern US watersheds (Deerfield and Merrimack) to explore major uncertainties related to headwater stream management across several federal, state, local, and non-profit natural resource managers. We aim to identify optimal stream management decisions that are robust to a range of scientific uncertainty and describe how value-of-information tools can be used to quantify the relative importance of alternative research programs and projects for informing stream conservation.

LEAF DECOMPOSITION AND SECONDARY PRODUCTION AS INDICATORS OF LAND-COVER CHANGE IN TROPICAL RIVERS

F. Silva-Júnior, Eduardo; Silva-Araújo, Monalisa; Tromboni, Flavia; Feijó de Lima, Rafael; Lourenço-Amorim, Christine; Neres-Lima, Vinicius; Thomas, Steven; Zandona, Eugenia; Moulton, Timothy

102C
Tuesday, 19 May, 2015 13:30 - 13:45

One of the largest threats to the integrity of aquatic ecosystems is the loss of riparian vegetation. Aquatic invertebrates contribute to leaf decomposition (LD), a fundamental process for energy release in small rivers, and form part of the secondary production (SP). These processes can be used as indicators of change in ecosystem functioning. This study assessed the effects of riparian deforestation at different spatial scales on: 1. physical-chemical parameters of rivers; 2. macroinvertebrate community structure and 3. ecosystem processes (LD and SP). The study was conducted in 27 sites of four tropical headwater streams. We used satellite images to quantify the riparian vegetation cover as a gradient of deforestation. Results showed that NH4 concentrations increased with increasing impact and shredders and over all richness were higher in the forest. LD decreased with deforestation and NH4 and was negatively related to shredder SP. LD was related to EPT taxa, SP, and %EPT. Our data suggest that loss of riparian vegetation has a significant impact on ecosystem processes and macroinvertebrate community structure, which in turn can be used as indicators of impact.

SALMON CARRION DECOMPOSITION INFLUENCES HEADWATER STREAM COMMUNITIES OVER TIME

Larson, Courtney; Weatherbee, Courtney; Pechal, Jennifer L.; Gerig, Brandon; Lamberti, Gary; Benbow, M. Eric

103DE
Tuesday, 19 May, 2015 13:30 - 13:45

Salmon carrion serves as a significant input of organic matter into headwater streams with lasting effects on the watershed. Our objective in this study was to determine the effect of salmon carrion introduction on aquatic macroinvertebrate and microbial communities over time. Chinook and Coho salmon carcasses were introduced to Hunt Creek, Michigan, downstream of a migration barrier. Upstream of that barrier served as a control reach, where salmon carrion was not present. Macroinvertebrates, benthic epilithic biofilms and water column microbial communities were sampled before (September) and during (October) carcass introduction along both reaches. Initial results indicate overall macroinvertebrate diversity was similar between control and salmon sites (Simpson's Index, genus = 0.12) both before and during carcass introduction. However, the abundance of the mayfly, Acerpenna, a common collector-gatherer, was significantly higher before carcass introduction at the control sites (ANOVA, $F=6.9057$, $p<0.05$). Epilithic biofilm communities were variable over time, with trending differences between control and carcass addition reaches. Our results provide some of the first information documenting salmon carcass biotic effects in Michigan headwater streams.

BIOGEOCHEMICAL FUNCTIONS MUST BE CONSIDERED INDIVIDUALLY WHEN EVALUATING STREAM RESTORATION OUTCOMES

Morgan, Joseph; White, Jeffrey; Royer, Todd

101CD
Tuesday, 19 May, 2015 13:30 - 13:45

Stream restoration is an often-used tool to improve impaired systems and offset functional losses elsewhere, but considerable doubt remains concerning its effectiveness in restoring biogeochemical functions such as nutrient retention and organic matter processing. These functions are rarely monitored in restored streams and are often inferred rather than measured, calculated as a single index from rapid structural assessments. This study investigated biogeochemical function in restored and unrestored reaches of Fawn River (IN); restoration focused on fine sediment and macrophyte removal. Ecosystem metabolism and nutrient uptake measurements were made during restoration and in the 12 months following restoration. Results highlight the importance of considering biogeochemical functions individually, as they may emerge to differing extents and over different timescales. Primary production and ecosystem respiration were strongly reduced in magnitude in the restored reach across all sampling events, suggesting whole-stream metabolism is a highly sensitive functional measure which responds rapidly to the restoration practices investigated. No discernable patterns in nutrient retention in restored or unrestored reaches were detected, suggesting that changes in nutrient retention may not emerge as fully or as quickly.

RELATIVE INFLUENCE OF ALTERED FLOW AND WATER TEMPERATURE ON STREAM HEALTH IN SIERRA NEVADA STREAMS, CALIFORNIA

Carlisle, Daren; May, Jason; Nelson, S. Mark

102D
Tuesday, 19 May, 2015 13:30 - 13:45

There is a need to understand specific streamflow characteristics that, when altered by humans, have the greatest effect on stream health. We designed a study to assess how flow and thermal alteration were associated with the condition of invertebrate communities in 30 Sierra Nevada streams that span a wide range of hydrologic modification. Daily water temperature and streamflows were continuously monitored, and basic chemistry and habitat conditions were characterized when invertebrate communities were sampled. Streamflow alteration, thermal alteration, and invertebrate condition were quantified by predicting site-specific natural expectations using statistical models developed at a large network of reference sites. Monthly flows were typically depleted during fall, winter, and spring. Thermal conditions of most hydrologically altered streams were colder than natural in summer but relatively natural during winter. The most influential predictor of invertebrate community condition was the degree of alteration of March flows, which suggests there are key interactions between hydrological and biological processes during this month. Thermal alteration was also an important factor—particularly at the more extreme hydrologically altered sites.

EFFECTS OF CONTAMINANTS ON STREAM BIOFILMS: AMPHETAMINE, ANTIHISTAMINE, AND SALT

Lee, Sylvia; Rosi-Marshall, Emma ; Paspalof, Alexis; Kelly, John; Kaushal, Sujay

103AB
Tuesday, 19 May, 2015 13:30 - 13:45

Urban streams receiving wastewater contain contaminants including illicit drugs, pharmaceuticals, and road salt. Contaminants may have complex, sublethal consequences on ecosystem structure and function. We focused on the effects of amphetamine, antihistamine (the active ingredient in Benadryl), and road salt on the algal and bacterial communities in stream biofilms. We used artificial stream experiments, as well as contaminant exposure substrates (CES) deployed in two urban and one suburban stream locations in Baltimore, Maryland. In artificial streams, all three contaminants suppressed gross primary production (GPP) of biofilms after 3 weeks of chronic exposure. Only salt significantly suppressed community respiration (CR). In Baltimore, biofilms on CES amended with antihistamine, salt, or a mix of both also showed suppressed GPP, except for CES with antihistamine in the most urban stream location, after two weeks. None of the contaminants suppressed CR, suggesting these bacterial communities are tolerant, especially in the most urban site. To understand the mechanisms underlying changes in metabolism, we examined composition of biofilm communities exposed to contaminants using microscopic identification of algae and high-throughput sequencing of bacterial and algal genes.

VARIATIONS IN COMPOSITION AND SIZE OF DISSOLVED ORGANIC MATTER ACROSS THE RIVER-LAKE INTERFACE IN SOUTHWEST LAKE MICHIGAN

Zhou, Zhengzhen; Guo, Laodong

101B
Tuesday, 19 May, 2015 13:30 - 13:45

Water samples along a river-lake transect from the Milwaukee River (MR) to open Lake Michigan (LM) were collected between July-2012 and May-2014 and characterized for DOC abundance, UV-absorbance, fluorescence EEM and colloidal size spectra using FFF techniques. DOC and a254 decreased from the MR to LM, showing a strong terrestrial influence on the bulk DOM. Colloidal (>1kDa) DOM comprised 52-70% of the bulk DOM, decreasing from the MR to harbor and open LM. PARAFAC modeling identified three humic-like (C1, C3, C4) and one protein-like (C2) DOM components, with increasing C2/C1 and in-situ production from river to the lake. Colloidal chromophoric and humic-like DOM showed major (>70%) size partitioning at the 0.5-4 nm size range, while protein-like DOM had additional peaks at the 4-8nm and >30nm size ranges. Ratio of protein-like DOM between the 4-8nm and 0.5-4nm size ranges increased from river to lake, similar to the ratio between the >30nm and 0.5-4nm size ranges, suggesting more protein-like DOM with higher molecular weight in open lake waters. Variations in DOM characteristics were closely linked to sources and biogeochemical processes.

SPECIES TRAITS COMPOSITION AND VARIABILITY INDICATE ENVIRONMENTAL CONDITIONS AND CHANGE IN ALPINE RUNNING WATERS

Füreder, Leopold

102B
Tuesday, 19 May, 2015 13:45 - 14:00

Alpine river ecosystems above the treeline are generally fed by glacial icemelt, snowmelt, and groundwater and share common features (e.g. steep gradients, high flow velocities and dynamics). Organisms well adapted to harsh environmental conditions contribute to a unique biodiversity, including endemic and threatened species. We tested the hypotheses that glaciation in the catchment is a major factor for defining the hydromorphological conditions, and the degree of harshness influencing taxa richness and diversity of the aquatic fauna. When we applied a set of species traits, indicating strategies and adaptations of resilience and resistance as well as to face environmental harshness, species trait composition and variability followed a predictable pattern. As alpine river ecosystems are under major pressure from climate change, altered hydrology with retreating glaciers and shrinking snow cover, carry for different environmental conditions but also biological and ecological abilities and traits within the aquatic communities. Species traits analyses are therefore well suited for the forecast of specific patterns and relationships between diversity and ecosystem function in climate change research.

CHARACTERIZATION OF BULK AND CHROMOPHORIC DISSOLVED ORGANIC MATTER IN GREEN BAY, LAKE MICHIGAN

DeVilbiss, Stephen; Zhou, Zhengzhen; Klump, Val; Guo, Laodong

101B
Tuesday, 19 May, 2015 13:45 - 14:00

Bulk dissolved organic carbon (DOC) analysis, UV-vis absorption, and fluorescence excitation-emission matrices (EEMs) coupled with parallel factor (PARAFAC) were used to quantify abundance, spatial distribution, composition, and sources of dissolved organic matter (DOM) in Green Bay, Lake Michigan in June 2014. DOC concentrations ranged from 202 – 571 µM-C with an average of 361 ± 73 µM-C. A significant south-to-north DOC gradient was evident, with the highest concentration in the Fox River, followed by stations near Sturgeon Bay. Absorption coefficient (a254) ranged from 12.4 – 58.5 m-1 with an average of 30.5 ± 8.9 m-1 and was significantly correlated to both DOC concentration and specific conductivity, attesting a significant terrestrial DOM source from the Fox River with higher molecular weight and aromatic components. Non-chromophoric DOM comprised ~32% of the bulk DOC, suggesting potential importance of photochemical processes. EEMs-PARAFAC modeling identified four major fluorescent DOM components, including two terrestrial humic-like, one aquagenic humic-like, and one protein-like component. The abundance and distribution of the terrestrial components buttress the dominance of riverine DOM and support a physicochemical control in southern Green Bay.

OVERCOMING UNCERTAINTY WITH MODERN STATISTICAL TESTS: WHAT YOU LEARNED IN COLLEGE IS PROBABLY OBSOLETE

Helsel, Dennis

102E
Tuesday, 19 May, 2015 13:45 - 14:00

Environmental regulations usually employ traditional approaches such as t-intervals, t-tests, analysis of variance and regression. Perhaps a flowchart specifies to first test for a normal distribution, and if data can be shown to be non-normal, a nonparametric procedure is reluctantly allowed. This two-stage process can lead to errors in decision-making on a number of levels. Newer computer-intensive statistical methods incorporate uncertainty without assumptions about the distributional shape of data. Test results (p-values) are valid regardless of shape, producing confident decisions about contamination, change, trend, etc. Regulations and standard procedures should be updated to reflect these well-accepted methods.

THE LEGACY OF LOGJAM LOSS ON BENTHIC MACROINVERTEBRATE BIOMASS AND INSECT EMERGENCE IN MOUNTAIN STREAMS

Venarsky, Michael; Walters, David; Herdrich, Adam; Winkelman, Dana; Livers, Bridget; Wohl, Ellen; Hall, Robert O.; Poole, Geoffrey

103DE
Tuesday, 19 May, 2015 13:45 - 14:00

Historically, the physical templates of western mountain streams were shaped by channel-spanning logjams, which increased sediment retention and created multi-thread streams channels. Today, the legacy effects of timber harvesting has reduced both wood input rates and logjam density in these streams. Here we examined mountain streams flowing through watersheds with various forest stand ages (100 to >350 years old) to determine how these systems function under both disturbed (e.g., low logjam density) and undisturbed (e.g., high logjam density) conditions. Preliminary results show that organic matter storage is ~3x higher in streams with logjams. However, benthic macroinvertebrate community biomass did not differ among streams and rates of aquatic insect emergence were lowest at sites with logjams. Trout population size was positively correlated with logjam density, suggesting that the lack of response within the benthic community was likely caused by higher trout consumption rates. Thus, while logjam strongly influence the geomorphology of mountain stream ecosystems, the primary mechanism through which they influence aquatic community structure and function is by modifying predator-prey dynamics.

BIOTIC RESPONSE TO FLOW ALTERATION IN MID-ATLANTIC STREAMS

Patrick, Christopher; Yuan, Lester

102D
Tuesday, 19 May, 2015 13:45 - 14:00

Hydrologic alteration is an important driver of stream impairment; however, it is difficult to study because hydrologic monitoring is not regularly performed with biomonitoring because of prohibitive costs. We avoided this issue by using a novel statistical method for modeling flow and applied the method to thousands of ungauged streams in Maryland that were sampled for invertebrates and fish. We ordinated the correlation between the daily flows of USGS gauged streams in the Mid-Atlantic in an NMDS and then fit GAM models to predict a stream's position in ordination space. The models were used to identify the best predictor gauges for each ungauged stream in the Maryland Biological Stream Survey dataset which we used to estimate hydrologic metrics (flashiness, magnitude, minimum flow, etc) relevant to fish and macroinvertebrates. We evaluated the relationship between flow and metrics related to community composition including richness, diversity, functional diversity, and traits specifically related to flow metrics, such as desiccation resistance. We also compared the range of values obtained for flow metrics across the dataset to values observed in reference quality streams in the region.

DIATOM BIODIVERSITY IN MEDITERRANEAN STREAMS AND ITS POTENTIAL FOR ENVIRONMENTAL ASSESSMENTS: A CASE STUDY FROM THE ISLAND OF CYPRUS

Cantonati, Marco; Kelly, Martyn; Armanini, David; Lange-Bertalot, Horst; Angeli, Nicola; Demartini, Daniele; Dörflinger, Gerald

103C
Tuesday, 19 May, 2015 13:45 - 14:00

Mediterranean streams are highly-stressed environments, mainly because of the wide seasonal fluctuation in water quantity. This natural pressure (which may be exacerbated by climate change) requires organisms to be specially-adapted, and is a significant challenge when establishing efficient assessment methods. We studied environmental parameters (ecomorphology, detailed hydrological background, physical and chemical variables) and diatom assemblages in almost 200 stations in a Cypriot stream network covering an area of about 5550 km2. The detailed taxonomic analysis was carried out using the latest taxonomic concepts. More than 350 taxa belonging to more than 70 genera were identified. Many interesting taxa were found, and several species new to science were discovered and characterized from both taxonomic and ecological standpoints. A comprehensive comparison with the somewhat-sparse literature allowed us to use this large and taxonomically-homogeneous database to point out relevant features of Mediterranean stream diatom assemblages. The diatom data were further analyzed from different perspectives (assemblage composition, diversity and taxonomic structure, natural and anthropogenic drivers, stream types etc.), with the objective of refining ecological assessments.

CO-LIMITATION BY N AND P CHARACTERIZES ALGAL COMMUNITIES ACROSS LAND USE AND NUTRIENT AVAILABILITY

Bratt, Anika; Finlay, Jacques; Welter, Jill; Vculek, Bree; Sarbacker, Kerrick

103AB
Tuesday, 19 May, 2015 13:45 - 14:00

Scientific understanding of nutrient limitation lacks predictive power and mechanistic clarity. Historically, freshwater systems were assumed to be singly limited by phosphorus (P), but a recent meta-analysis demonstrated that algal response to nutrient manipulation most frequently supports co-limitation by nitrogen (N) and P. However, the role of resource availability and the ratio of this availability on nutrient limitation of aquatic primary producer communities remains unclear. Therefore, the goal of our research was to determine how resource availability and land use influence nutrient limitation by N and P of primary production in aquatic communities across 9 lakes in Minnesota.Despite large differences in land use (agricultural, urban, and suburban), nutrient loading, and nutrient availability, algal communities' response to nutrient manipulation was consistently characterized by a co-limitation by N and P. These results suggest that lake processes (denitrification, nitrogen fixation) likely contribute to nutrient limitation.

IMPACTS OF RESTORATION ON ECOSYSTEM PROCESSES IN MIDWESTERN STREAMS

Fulgoni, Jessica; McLeran, Kerry; Whiles, Matt; Rantala, Heidi; Beattie, Alicia

101CD
Tuesday, 19 May, 2015 13:45 - 14:00

Several kilometers of degraded stream reaches in the US are restored annually, but few projects are monitored after completion. Besides modifications to physical attributes, the influence of such restorations on ecosystem processes remains largely unknown. We sampled seven Midwestern streams that had undergone habitat restorations from 4-15 years prior to our study. Restoration techniques included in-stream habitat enhancements, bank stabilization, and riparian restoration. Restored reaches and unrestored upstream reaches were sampled for water chemistry and biological processes. Whole stream metabolism was estimated using a single station approach. We predicted that gross primary production (GPP) would be lower in restored streams because of decreased nutrient inputs, and that respiration would be greater because of increased litter inputs from restored riparian areas. However, GPP in restored sites was significantly higher than unrestored sites ($t_6 = -4.9$, $p = 0.002$), despite no differences in PO_4^{-3} and NO_3^- concentrations. Five restored sites were autotrophic ($P/R > 1$), while six unrestored sites were heterotrophic. Results suggest that restoration projects are shifting streams to an autotrophic state, likely due to changes in canopy cover and light penetration.

SCALING ECOSYSTEM RATES IN STREAM MESOCOSMS ALONG A GRADIENT OF CONSUMER DENSITIES

Gido, Keith; Pennock, Casey; Dodds, Walter

101A
Tuesday, 19 May, 2015 13:45 - 14:00

Stream organisms that range in size from microbes to large predators are often patchily distributed, resulting in heterogeneous distributions of organic matter and ecosystem rates. Identifying how ecosystem properties scale from heterogeneous patches to reaches, segments and catchments is necessary to quantify critical stream ecosystem services of streams such as nutrient processing and retention. We measured ecosystem rates (gross primary productivity, net primary productivity and ecosystem respiration) at both the patch (10 cm x 10 cm basket) and reach (10 m) scales in experimental stream mesocosms that were stocked with nine densities of central stonerollers Campostoma anamolum ranging from zero to 25 g/m2. Patch and reach scale measurements of ecosystem rates were weakly related, highlighting difficulties in accurately sampling and extrapolating small-scale heterogeneity to larger scales. However, increasing densities of central stonerollers resulted in greater GPP at both patch and reach scales. The positive feedback between grazers and primary production is likely to apply at larger scales resulting in important consequences for ecosystem functioning of small streams.

MITIGATING LEGACY AND FUTURE NUTRIENT LOADS AT THE LANDSCAPE AND WATERBODY SCALE USING GOOD QUALITY CARBON AS A TOOL

Szafraniec, Mary

102C
Tuesday, 19 May, 2015 13:45 - 14:00

The legacies of past nutrient loading to groundwater and surface waters by land use changes have left their mark on aquatic ecosystems. Nutrient concentrations continue to escalate even after significant reductions in external nutrient loading from point and non-point sources. Positive water quality responses following external nutrient reductions are influenced by the quantity and quality of carbon available in the system. Reduction of carbon through disconnection of floodplain and riparian wetlands adjacent to streams and rivers have depleted carbon-rich sources that provide the mechanism and driving factor for nutrient cycling and subsequent nutrient removal from aquatic systems. Emerging technologies aimed at alleviating carbon limitation using carbon amendments and innovative re-vegetation methodologies have proven to be very effective at reducing nutrient loads into aquatic resources. The key is to understand and reintroduce the appropriate conditions and levels of bioavailable carbon fractions that vary from labile to refractory to optimize the nutrient removal efficiency of a landscape or aquatic ecosystem. Specific strategies for using various sources of carbon to mitigate the effects of nutrients on groundwater and lotic systems will be highlighted.

THE EFFECTS OF LAND COVER AND CLIMATE ON NUTRIENT LOSS AND RETENTION IN HUMAN DOMINATED WATERSHEDS

Boardman, Evelyn; Finlay, Jacques

102C
Tuesday, 19 May, 2015 14:00 - 14:15

Anthropogenic activity strongly alters nutrient transport and processing in watersheds, particularly in agricultural and urban lands. We sought to determine how land cover and climate interact to influence nutrient losses from 78 sites in Minnesota. Five year average annual loads (2007 – 2011), encompassed a period of substantial variation in runoff. Overall, watersheds with lower runoff had greater N retention across a wide range of land use. Wetland cover is positively related to retention when N inputs are high, but negatively related and more variable when inputs are low. Sites in Northern Minnesota have low N retention because their losses of all forms of N are high relative to their low anthropogenic inputs. In highly agricultural watersheds, more wetland cover is associated with lower TKN and NO3 + NO2 losses and higher TN retention. Remnant lakes and wetlands are important to mitigating anthropogenic impacts on watersheds. Human dominated watersheds with lakes and wetlands (and potentially lower amounts of tile-drained fields) may retain more water and nutrients.

CHARACTERIZATION OF RIVERINE ORGANIC MATTER IN AN URBAN LANDSCAPE

Kelso, Julie; Epstein, Dave; Baker, Michelle

101B
Tuesday, 19 May, 2015 14:00 - 14:15

Dynamics of allochthonous and autochthonous organic matter (OM) in aquatic systems have been studied for decades, but urban studies have revealed additional, less studied, OM sources such as storm water, lawn clippings and wastewater effluent. We used the natural abundance of carbon, nitrogen and hydrogen isotopes to determine the sources of coarse particulate organic matter (CPOM), fine particulate organic matter (FPOM), and dissolved organic matter (DOM). Organic matter was sampled at 32 sites, in 4 watersheds that encompass a range of urban, suburban, range, and agricultural land uses in north east Utah. The proportional contribution of each source was estimated using the Stable Isotope Analyses in R package. CPOM was dominated by terrestrial sources (mean = 52%, range 35-61%), and FPOM by autochthonous sources (mean = 54%, range 38-68%). DOM carbon and hydrogen isotope signatures indicate primarily terrestrial DOM (d13C mean = -25.9 ‰ ± 0.5‰ and d2H = -98 ‰, ± 15.4‰). DOM spectroscopy indices including the Fluorescence Index, and SUVA254, were variable across all sites suggesting a mixture of microbial and terrestrially DOM regardless of land use.

LIFE-HISTORY RESPONSES OF AMPHIDROMOUS FISH TO HYDROLOGIC VARIATION AMONG HAWAIIAN STREAMS

Lisi, Peter; McIntyre, Dr. Peter; Hogan, Derek; Blum, Michael; Gilliam, Jim

101A
Tuesday, 19 May, 2015 14:00 - 14:15

Freshwater streams across the Hawaiian Archipelago are characterized by flashy flow regimes that appear to be shifting with climate change. Here, we summarize the intra-annual variability in daily stream flow on five islands, and examine how the geomorphic characteristics of catchments mediate hydrological variation. The most stable hydrologies were found in streams that drain small, steep, highly eroded catchments along the windward/rainy side of islands. More variable flow regimes were generally found on younger islands draining narrow catchments. To assess the biological consequences of hydrological complexity, we used otolith microchemistry to identify individual gobies (Awaous stamineus) that remained in the stream environment as larvae rather than going to sea. We found that the hydrologic variability was correlated to the proportion of the goby population that went to sea: the more variable the stream, the more likely that gobies are truly amphidromous. This life-history flexibility may be important for population resilience as stream flows are further altered by climate change and water abstraction for human use.

EFFECTS OF A POLLUTED RESERVOIR ON THE DISTRIBUTION OF THE BENTHIC AND INTERSTITIAL CRUSTACEAN COMMUNITY (NORD-WEST ALGERIA)

Belaidi, Nouria; Taleb, Amina

103DE
Tuesday, 19 May, 2015 14:00 - 14:15

Nord-africain aquatic ecosystems, are heavily altered and exhibit a disproportional loss of invertebrate. This study aimed to identify the response of the micro-crustacean assemblages to impacts, caused by industrial contamination, and reservoir management on downstream hydrosystems. This was done by surveying the patterns of crustacean's distribution in a 300 m stretch of the middle part of the Tafna River, downstream from the dam of the Hammam Boughrara Reservoir, during natural high water, low water and reservoir water releases. Seven piezometers were sampling monthly during two years. Crustacean species were different between surface and hyporheic zone. The following species were found only in the hyporheic zone: Harpacticoidae, Pseudocandona pratensis and the stygobites species, Typhlocirolana sp, Microcharon sp., Gammaridae and Bathynellidae. These taxa were high sensitive to the hydrological modifications. A significant decrease in density of Acanthocyclops, Harpacticoides, Typhlocirolana sp. and Microcharon sp., and disappearance of some taxa were observed downstream of the dam during reservoir water releases. These results could be linked to the combination of current velocity, vertical hydraulic gradient, grain sizes, dissolved oxygen and biochemical oxygen demand.

SPATIAL AND TEMPORAL VARIATION OF PERIPHYTON ASSEMBLAGES AND ASSOCIATED ENVIRONMENTAL CONDITIONS IN THE KLAMATH RIVER (2004-2013), CALIFORNIA, USA

Gillett, Nadia; Pan, Yangdong; Asarian, J. Eli; Kann, Jacob

103C
Tuesday, 19 May, 2015 14:00 - 14:15

Poor water quality conditions in the Klamath River (California, USA) are associated with low dissolved oxygen and high pH as a result of photosynthesis and respiration by periphyton, aquatic plants, and phytoplankton. To examine spatial and temporal patterns in periphyton assemblages, we analyzed samples collected during summer (May-August) and fall (September-November) of nine years (2004, 2006-2013) from 11 sites (n=398) in Klamath River and its largest tributary, Trinity River. Periphyton assemblages were dominated by diatoms (average 92.5% of samples relative biovolume), followed by cyanobacteria (6.0%), and green algae (1.5%). Periphyton assemblages showed clear longitudinal (i.e., upstream vs. downstream) and seasonal patterns (i.e., May-June vs July-October) in species composition. These patterns were associated with a seasonal gradient from low temperature and high flow (i.e., spring and early summer) to high temperature and low flow (i.e., late summer and fall) conditions. Nutrients defined a second longitudinal gradient from upstream nutrient-rich sites to downstream sites with lower nutrient concentrations. This long-term dataset will inform river management decisions such as reducing upstream nutrient loads, setting flow regimes, and potential dam removals.

STABLE ISOTOPE FOOD WEBS SUGGEST INCOMPLETE RECOVERY IN ACID MINE DRAINAGE REMEDIATED STREAMS

Drerup, Sam; Johnson, Kelly; Vis, Morgan

101CD
Tuesday, 19 May, 2015 14:00 - 14:15

Remediation of streams impaired by acid mine drainage (AMD) is often successful in reducing acidity and dissolved metals. Biological communities, as measured by multimetric indices, which emphasize taxonomic diversity, often show a similar pattern of recovery. However, the goal of restoration is to improve both biological communities and processes within the stream. Previous research has suggested that AMD-remediated streams exhibit decreased primary productivity in comparison with unimpaired streams. In this study, we investigated the impact of this potential difference in system function by examining food web dynamics using stable isotopes for three AMD-unimpaired, three AMD-impaired, and three AMD-remediated streams in southeastern Ohio. Compared with unimpaired streams, autochthonous resources (chlorophyll a) in remediated and impaired streams were reduced. Isotopic analysis showed that three invertebrate predators (Aeshnidae, Calpterygidae and Corydalidae) had lower reliance on autochthonous basal resources in remediated and impaired streams. Impaired streams had significantly reduced trophic niche space compared to unimpaired and remediated streams. Our results suggest that although the taxonomic diversity in these remediated streams has improved, food webs are still heavily dependent on detritus based carbon sources.

SUSTAINABILITY: OXYMORON OR MEASURABLE METRIC?

Kaster, Jerry

102E
Tuesday, 19 May, 2015 14:00 - 14:15

Sustainability is a vital component of “our freshwater futures”. The advancement of technology from scientific endeavors and technological assimilation into economies is the principal tool that compensates for poor sustainability practices that result in generational resource exploitation. As prime resources dwindle, technology has become the main societal ingredient that promotes more efficient use of previously compromised resources. This applies to both nonrenewable resources and renewable resources that have a deteriorative use rate greater than their renewable rate. In this representation, sustainability is a process that maximizes resource utility, within the confines of system efficiency and chaos restraints that reduces the rate of resource degradation. As a measurable practice, sustainability is applied to any localized growth system for determination of resource use matched to resource renewal rate.

PATTERNS OF POLYPHOSPHATE STORAGE IN STREAM BIOFILMS IN RESPONSE TO PHOSPHORUS STRESS

Rier, Steven; Kinek, Keith; Hay, Sarah; Francoeur, Steven

103AB
Tuesday, 19 May, 2015 14:00 - 14:15

There has been considerable interest in the role of polyphosphate (poly P) in marine biogeochemical cycles, yet there is also a high likelihood that poly P plays a critical role in the phosphorus (P) dynamics of streams and rivers. We used a combination of field observations and artificial stream mesocosm experiments to examine patterns in poly P formation in stream biofilms. We found that both natural and artificial P pulses result in temporary elevations in poly P, which immediately subsided as growth rates increased. However, mesocosm experiments also revealed the greatest elevation in poly P occurred during later stages of community development in biofilms that were grown under the most P-stressed conditions. These observations were confirmed in a survey of 23 streams across a landscape P gradient in central Pennsylvania. Although stream microorganisms utilize poly P as a way to capitalize on P delivered in shot pulses, such as during storm runoff events, our results indicate that it is possible that poly P plays other roles in the response of biofilm inhabitants to P stress.

MEASURING ELEVATION RANGE SIZES TO TEST THE CLIMATE VARIABILITY HYPOTHESIS AND ASSESS LATITUDINAL DIFFERENCES IN SPECIES VULNERABILITY TO CLIMATE CHANGE

Gill, Brian; Kondratieff, Boris; Encalada, Andrea; Ghalambor, Cameron; Simmons, Mark; Funk, Chris; Poff, LeRoy

102B
Tuesday, 19 May, 2015 14:00 - 14:15

To understand species vulnerability, researchers are characterizing species sensitivity using trait-based approaches. Phylogenetic comparative analyses analyze trait data on phylogenies to understand trait diversity. We designed a test of the Climate Variability Hypothesis (CVH) to explore potential differences in species' sensitivities resulting from differences in species' evolutionary histories. The CVH predicts that temperate species will be broadly adapted to the variable thermal conditions of high latitudes, whereas tropical species will be narrowly adapted to the relatively stable thermal condition of low latitudes. Consequently, temperate species should be more broadly distributed geographically than tropical species. Along elevation gradients, temperate species should spread broadly, whereas tropical species should be narrowly distributed. We collected aquatic insects from streams in 200 m elevation intervals along transects spanning nearly 2000 m in the Colorado Rockies and the Ecuadorian Andes. Taxa were identified using an integrative approach. We estimated a phylogeny for these species and tested for an association between latitude and the trait elevation range breath using phylogenetic regression. Our results suggest that tropical species are more sensitive than temperate species to global warming.

CHARACTERIZING THE IMPACTS OF ALTERNATIVE FLOW REGIMES ON MULTIPLE BIOLOGICAL INDICATOR COMMUNITIES: CONGRUENCE, CORRELATION AND MANAGEMENT STRATEGY

Wynne, Caroline; Sweeney, Niamh; Linnane, Suzanne

102D
Tuesday, 19 May, 2015 14:00 - 14:15

Where two communities are concordant, there is potential for one to be used as a surrogate for the other. This is important for water quality assessments, understanding ecohydrological conditions, and predicting responses of communities to hydromorphological alterations. We assessed the concordance of stream biological communities across flow regimes (slope). Stream macroinvertebrate and diatom communities were compared across 3 management-defined river flow regime categories. Macroinvertebrate community composition varied among flow regimes. Sites of low flow had similar communities, sites of high flow had similar communities, but communities at sites of moderate flow were not distinctly different from those of low or high flow. Diatom community composition did not vary among the flow regimes defined in the current study. Macroinvertebrate and diatom communities were not significantly concordant, either within or between flow regime categories. These findings do not support the use of management strategies that use river flow regime as determined by slope, suggesting that finer scale measurement or habitat assessment may be required for each taxonomic grouping of interest.

FUTURE DIRECTIONS FOR USING NATURAL VARIABILITY TO DEVELOP TRIGGERS FOR DESIGNING AND ADAPTING ENVIRONMENTAL MONITORING PROGRAMS

Munkittrick, K.R.; Arciszewski, T.J.; Kilgour, B.W.; Somers, K.; Barrett, T.J.

102E
Tuesday, 19 May, 2015 14:15 - 14:30

A big challenge in biological monitoring is how to incorporate natural variability in biological endpoints into decision-making. As the temporal and spatial scales of monitoring increase in long term programs, available statistical power increases the potential for identifying very small changes. There are huge costs and risks to management decisions based on small biological changes which may be ecologically meaningless, or for which there is an insufficient historical baseline data to inform decision-making. We have identified a conceptual model for a scalable adaptive monitoring framework that defines changes using a normal or expected range for biological data, based on measures of natural variability at multiple spatial and temporal scales. The estimates of the normal range limits are dependent on the quantity of data, improve over time, and stabilize around 2 SD when adequate baseline data are available. This adaptive monitoring framework can be used to identify triggers to define when local change is of sufficient concern that it needs focused attention, and allows the prioritization of resources to areas with the most uncertainty or change.

EFFECTS OF ANTHROPOGENIC DISTURBANCES ON AQUATIC MACROINVERTEBRATES - DEPOSITION AND THERMAL REGIMES, OR THE IMPORTANCE OF APPROPRIATE SITES SELECTION

Trottier, Gabrielle; Turgeon, Katrine; Nozais, Christian; Solomon, Chris; Gregory-Eaves, Irene

103DE
Tuesday, 19 May, 2015 14:15 - 14:30

Aquatic ecosystems are exposed to many anthropogenic pressures. One of them is the construction of dams that control the water level and sometime lead to winter drawdown. These dams are important to reduce spring flooding and produce hydropower but they also cause annual water level variations ranging from <1m to >15m. These variations can affect littoral macroinvertebrates communities via desiccation, freezing and habitat loss. It was shown that drawdown affects, positively or negatively, macroinvertebrates abundance and biodiversity, but there is no clear consensus. This lack in consensus is most likely the result of small sampling size and/or no habitat subsampling. Knowing that the abundance and community composition is influenced by the environment in the context of natural water level variations (<1m), it will be shown that the deposition and thermal environments, where you sample macroinvertebrates, also influence the abundance and the composition of the macroinvertebrates found in your sample in the context of anthropogenic disturbance (i.e. drawdown). Theses results will enable the optimization of sites selection and thus a better understanding of the impacts of anthropogenic disturbances on macroinvertebrates communities.

USE OF ANNUAL HYPORHEIC TEMPERATURES SIGNALS TO EVALUATE THE EFFECTS OF CHANNEL REALIGNMENT

Amerson, Byron; Poole, Geoffrey; O'Daniel, Scott; Lambert, Michael

101CD
Tuesday, 19 May, 2015 14:15 - 14:30

Channel and aquifer geomorphology govern the rate and pattern of hyporheic exchange and also the mechanisms of heat exchange between the channel and hyporheic zone. Therefore, documenting how reach-scale alterations of channel planform alter rates and patterns of hyporheic exchange can inform our understanding of heat exchange between the channel and hyporheic zone. Here, we document how large-scale channel realignment affects the temperature of the aquifer and surface water, utilizing annual temperature signals measured at the restoration site and modeled changes in hyporheic flow patterns. By a novel application of the advection-diffusion equation, we can predict water temperature at any point and time along a hyporheic flow path. We use the equation to predict temperature along modeled hyporheic flow paths pre- versus post-alignment, which we present here.

CHARACTERIZATION OF DISSOLVED ORGANIC MATTER IN THE LAURENTIAN GREAT LAKES USING FLUORESCENCE EEM AND PARAFAC TECHNIQUES

Guo, Laodong ; Zhou, Zhengzhen; Minor, Elizabeth

101B
Tuesday, 19 May, 2015 14:15 - 14:30

Chromophoric and fluorescent-DOM was characterized for surface waters in all Laurentian Great Lakes including Lake Superior (LS), Michigan (LM), Huron (LH), Saint Clair (LSC), Erie (LE), and Ontario (LO). DOC-concentrations, a254 and SUVA254 increased from LS to LE and LO, reflecting a change of DOM sources and reworking processes along the water transport pathway. DOM humification index was the highest in LE while the biological index (BIX) was the highest in open lake waters. Higher DOC abundance in LE, LO, and north LM was accompanied by higher aromaticity, molecular weight, and humification degree, but lower spectral slope (S275-295), and BIX values, suggesting sources of terrestrially-derived DOM from surrounding catchments. PARAFAC analysis on EEM data revealed four major fluorescent DOM components in the Great Lakes, including three terrestrial humic-like DOM components and one protein-like DOM component. The ratio of protein-like/humic-like DOM was the highest in open LH, but lowest in LE and LO. Changes in DOM composition along the water transport pathway in the Great Lakes indicate varying impacts from terrestrial inputs and human activities in the different lake systems.

INSECT DIET AND STOICHIOMETRY ALONG A TROPICAL ELEVATION GRADIENT

Atkinson, Carla L.; Encalada, Andrea; Flecker, Alexander; Thomas, Steven

102B
Tuesday, 19 May, 2015 14:15 - 14:30

Food resource availability varies along the river continuum, but can also vary along gradients of elevation and temperature. In alpine ecosystems, streams can originate above or below tree line, thus influencing the relative availability of allochthonous and autochthonous resources. We sampled thirteen streams of similar size (e.g. discharge, width) along an elevation gradient in two basins in the Ecuadorian Andes. The stable isotope signature (?13C, ?15N, ?D) and carbon, nitrogen and phosphorus composition of basal food resources (periphyton, and coarse particulate organic matter) and insects varied with elevation. We found that algal-based food resources primarily supported insects occurring at higher elevations with a shift to greater allochthony at lower elevations, corresponding with lower light availability at low elevation sites. Additionally, % phosphorus of both food resources and insects declined over the gradient, indicating that resources at high elevations were overall lower in quality. Nevertheless, insects may be able to compensate for this low quality food due to both altered body stoichiometry and the higher quality and quantity of the algal-based foods in comparison to detrital-based foods at high elevations.

OF FIRE, FOOD, AND FISH: AN INVESTIGATION OF FISH PRODUCTIVITY RESPONSES TO WILDFIRE IN WILDERNESS STREAMS OF IDAHO

Schenk, Matthew

101A

Tuesday, 19 May, 2015 14:15 - 14:30

Increases in frequency and severity of wildfire associated with a warming climate are changing vegetation patterns in the western U.S. Many streams once fringed by conifer forests have burned but retained open canopy and elevated light for more than a decade, rather than returning to pre-fire conditions. We hypothesize this may be responsible for a pulse of productivity by stream algae, invertebrates and fishes that may extend >10-15 years following severe fires. We investigated this hypothesis using a nested study design: first, a spatially extensive comparison and multi-factor analysis of organisms across streams spanning gradients in fire history and recovery, and second, a temporally intensive, multi-trophic level comparison of production rates between paired streams contrasting in riparian regrowth following fire. Results revealed 2-3X higher biomass and production of organisms in streams retaining an open canopy after wildfire versus those that regained their canopy. Moreover, primary producer, invertebrate and fish patterns were most strongly associated with light versus factors like nutrient concentrations or temperature, suggesting riparian regrowth may mediate mid- to long-term responses of stream productivity to wildfire.

LAND USE INTERACTIONS DRIVE SOUTHWESTERN ONTARIO STREAM NUTRIENT CONCENTRATIONS

Thomas, Kathryn; Lazor, Renee; Chambers, Patricia; Yates, Adam

102C
Tuesday, 19 May, 2015 14:15 - 14:30

Land use activities such as agriculture and urbanization have transformed the landscape in southwestern Ontario and contributed to eutrophication of tributaries and downstream lakes. To quantify the cumulative influence of spatial patterns in land use and land cover on nutrient concentrations in tributaries of Lakes Erie and Huron, we sampled 29 river sites spanning a gradient in land use (60 – 90% agriculture) and phosphorus concentrations (0.0003 – 0.575 mg/L). Ordinary least squares regression identified significant, positive relationships between many nutrient parameters (e.g., TKN, TN, SRP and TP) and land use descriptors with the strongest being $NH3^-$, which was driven by a combination of agricultural land use in the watershed and the population served by sewage treatment plants (similar to TKN and SRP). In contrast, concentrations of TN and TP were only associated with the population served by sewage treatment. Our results showed that even in this highly modified landscape, increases in specific nutrient parameters are associated with identifiable human activities. The results from this study will help inform nutrient criteria development and management recommendations for Lake Erie tributaries.

RESPONSE OF TESTATE AMOEBAE AND PLANT COMMUNITIES TO PEATLAND RESTORATION PROCESSES: IMPLICATIONS FOR COMMUNITY CONCORDANCE

Daza Secco, Emmanuela; Haimi, Jari; Meissner, Kristian

103C
Tuesday, 19 May, 2015 14:15 - 14:30

Most bioassessment studies have focused on the responses of single taxonomic groups to changes in environmental factors. However, the degree to which taxonomic groups actually mirror trends between other organisms and can be used as surrogates for bioassessment is not always known. Many natural peatlands have undergone degradation due to human exploitation. Bioassessment studies using plant communities after peatland restoration have shown that this taxonomic group can be used to indicate degree of recovery. However, concurrent changes in the microorganisms' communities of restored peatlands are poorly known. Here, we compare and assess concordance of the changes in testate amoebae and plant community structures among natural, drained, and restored boreal peatlands. We noted that while both communities showed responses to the different peatland states, responses to the environmental factors differed, and no concordance could be detected between testate amoebae and plant communities. The lack of observed concordance is likely to be caused by the differences in testate amoebae and plant community generation and colonization times which manifest themselves in different responses to the environmental factors.

INCORPORATING SPECIES TRAITS IN A GUILD APPROACH TO DEVELOP ENVIRONMENTAL FLOW RECOMMENDATIONS FOR FRESHWATER MUSSELS

Gates, Kiza; Vaughn, Caryn C.; Julian, Jason P.

102D
Tuesday, 19 May, 2015 14:15 - 14:30

North American freshwater mussels (Unionidae) are imperiled and very sensitive to flow alterations. Previous attempts to develop environmental flows for mussels have struggled to accommodate their varied habitat requirements and complex life histories. We review what is known about the habitat requirements of mussels, how they can vary among species within a community, and how this variation influences the effectiveness of different environmental flow methodologies. We propose a trait based environmental flow method that addresses the needs of mussel guilds differentiated by their thermal tolerances and reproductive strategies. Used previously for fish, plants and macroinvertebrates, the guild approach groups species by traits and identifies flow requirements of guilds as opposed to entire communities. We apply the guild approach to the mussel fauna of the Kiamichi and Little Rivers in southeastern Oklahoma, U.S.A., and illustrate how changes in the hydrograph can be made to better meet the seasonal flow needs of differing mussel guilds and their host fish. The guild approach can be adapted among regions where trait data are available or combined with rating models that estimate trait data.

NMR-BASED METABOLOMICS OF CRAYFISH AS A BIOINDICATOR OF ECOSYSTEM HEALTH OF STREAMS IN SOUTHERN MANITOBA

Brua, Robert; Yates, Adam; Culp, Joseph

103C
Tuesday, 19 May, 2015 14:15 - 14:30

Nutrient losses and contaminants from human activities to aquatic ecosystems in southern Manitoba are a serious threat to ecological integrity of these waterways. Metabolomics is the quantification and characterization of small molecules called metabolites, which are derived from normal processes within a cell, tissue or biofluid. Environmental metabolomics characterizes the biochemical products of interactions between living organisms and their environment. Therefore, environmental metabolomics has the potential to assess how environmental stressors (e.g., pesticides, pharmaceuticals, nutrients) affect the biological health of an exposed organism and/or identify biomarkers of stress. Using NMR-based metabolomics, we evaluated if the metabolome (the set of all detected small molecules) of northern crayfish (Orconectes virilis), could be used as a bioindicator of environmental exposure to stressors associated with agricultural and rural land use activities. Indicator potential was assessed based on the strength of association between the crayfish metabolome and human activity gradients of agricultural and human wastewater treatment activities. Results of this study will be used to inform future studies aimed at evaluating and calibrating the crayfish metabolome to serve as a diagnostic indicator of environmental stressors.

ADULT RAINBOW TROUT HABITAT SELECTION IN THE HENRY'S FORK OF THE SNAKE RIVER, IDAHO

Kuzniar, Zach; VanKirk, Rob; Snyder, Eric; Luttenton, Mark

101A
Tuesday, 19 May, 2015 14:15 - 14:30

The Henry’s Fork is a high-elevation, 4th-order, groundwater-dominated river with notable seasonal changes in aquatic habitat. Previous fisheries research has focused on factors limiting the rainbow trout population. As a result, management and restoration were directed toward increasing recruitment. With current population numbers now equal to historical highs, our research focus has shifted to adult rainbow trout ecology and behavior. Field work during the summers of 2013 and 2014 was conducted in order to quantify available aquatic habitat and link trout position to environmental variables. Detailed habitat surveys indicate that macrophyte cover substantially increases throughout the summer and is a strong determinant of in-stream habitat characteristics. Paired logistic regression shows that adult rainbow trout prefer greater depths. Water levels are highly dependent on macrophyte abundance at the reach scale, and available trout habitat increases through this interaction. However, when macrophyte abundance is high, adult trout show secondary preference for localized areas of lower macrophyte cover but otherwise show no selectivity for macrophyte cover, velocity, or substrate size.

USING SEASONAL DATA ON NUTRIENTS AND ALGAL BIOMASS TO INFORM THE DESIGN OF MORE EFFECTIVE AND EFFICIENT WATER QUALITY MONITORING

Konrad, Christopher; Munn, Mark

103AB
Tuesday, 19 May, 2015 14:15 - 14:30

Water quality monitoring programs face a tradeoff between spatial and temporal coverage. We use monthly data collected at 22 site in three agricultural regions of the United States to examine assumptions underlying synoptic design and to develop an more effective and efficient approach for monitoring benthic algae. Maximum benthic chlorophyll (ChlaMax) ranged from 14 to 406 mg/m2 (at-site median 118 mg/m2) and exceeded 100 mg/m2 at 13 sites. No month represented a reliable reference period for ChlaMax. Algal biomass accrued rapidly and persisted for no more than 1 to 3 months. At-site variation of monthly chlorophyll was equal to the cross-site variation in ChlaMax. A single sample of chlorophyll does not provide a reliable index of ChlaMax and there were no regionally consistent reference periods other than spring and late summer when sampling would be likely to capture high algal biomass. A single sample of DIN collected at random, however, was a useful indicator of ChlaMax. Integrating temporal information into synoptic design can lead to more effective and efficient monitoring.

FUTURE DIRECTIONS FOR USING NATURAL VARIABILITY TO DEVELOP TRIGGERS FOR DESIGNING AND ADAPTING ENVIRONMENTAL MONITORING PROGRAMS

Munkittrick, K.R.; Arciszewski, T.J.; Kilgour, B.W.; Somers, K.; Barrett, T.J.

102E
Tuesday, 19 May, 2015 14:30 - 14:45

A big challenge in biological monitoring is how to incorporate natural variability in biological endpoints into decision-making. As the temporal and spatial scales of monitoring increase in long term programs, available statistical power increases the potential for identifying very small changes. There are huge costs and risks to management decisions based on small biological changes which may be ecologically meaningless, or for which there is an insufficient historical baseline data to inform decision-making. We have identified a conceptual model for a scalable adaptive monitoring framework that defines changes using a normal or expected range for biological data, based on measures of natural variability at multiple spatial and temporal scales. The estimates of the normal range limits are dependent on the quantity of data, improve over time, and stabilize around 2 SD when adequate baseline data are available. This adaptive monitoring framework can be used to identify triggers to define when local change is of sufficient concern that it needs focused attention, and allows the prioritization of resources to areas with the most uncertainty or change.

IS IT WORKING? USING FISH MOVEMENT TO ASSESS EFFECTS OF SMALL SCALE FISH HABITAT RESTORATION

Matthys, Tony; Huckins, Casey

101A
Tuesday, 19 May, 2015 14:30 - 14:45

As part of a spawning habitat restoration we manipulated the benthic habitat of a river reach by removing fine sediments. We expected increases in fish habitat preference in the manipulated reach due to the documented negative effects of embedded substrates on salmonid populations. Prior to sand removal surficial stream substrates were nearly 100% sand in the manipulated reach as well as upstream and downstream reference reaches. Immediately after the manipulation the substrate consisted of unembedded coarse substrates in the removal reach and sand in the reference reaches. This condition was maintained throughout the year until pulse of sand bedflow embedded the manipulated substrates the following summer. We monitored brook trout (Salvelinus fontinalis) and sculpin (Cottus spp) fish movement and habitat use in each of these three phases of the substrate composition in order to test different metrics of fish habitat preference. We compared fish turnover rates, immigration rates, and densities with observed patterns of movement and use. We found immigration rate best matched expected patterns of habitat preference through time and among the different sites.

SPATIAL VARIABILITY IN A EUTROPHIC LAKE DURING FALL TURNOVER

Loken, Luke; Crawford, John ; Casson, Nora; Butitta, Vincent; Stanley, Emily

101B
Tuesday, 19 May, 2015 14:30 - 14:45

Assessments of spatial variability in lakes are often limited and extrapolations from a small number of sampling points increase uncertainty with respect to elemental budgets, and the underlying drivers of important processes such as primary production. We mapped surface water chlorophyll and CO2 on Lake Mendota, WI in Oct-Nov 2014 during fall turnover using a high-resolution sensor platform (> 35,000 spatially-distributed measurements). Surface water concentrations of chlorophyll and CO2 increased during lake turnover suggesting that the hypolimnion released stored nutrients and dissolved gas. Turnover increased lake-wide primary production and carbon dioxide efflux. Spatial patterns of chlorophyll and CO2 revealed strong contrasts across the lake's surface. Littoral zones and river mouths had higher concentrations of chlorophyll and lower CO2 than pelagic zones. Spatial variability in these parameters was greatest in the nearshore areas, as complex sediment-surface water interactions lead to large variations in surface water conditions. While using single point observations in the middle of lakes may accurately represent metabolic and efflux rates across pelagic zones, such datasets are not representative of processes in littoral and riverine transition zones.

RECOVERY OF AQUATIC MACROINVERTEBRATE ASSEMBLAGES FOLLOWING STREAM DRYING IN SOUTHWEST GEORGIA, USA

Smith, Chelsea; McCormick, Paul V.; Covich, Alan; Golladay, Stephen

103DE
Tuesday, 19 May, 2015 14:30 - 14:45

Demand for agricultural irrigation water during recent droughts has been associated with an increase in the number of intermittent stream miles in the lower Flint River drainage basin in southwest Georgia. We sampled macroinvertebrate assemblages over 9 months in intermittent stream reaches that either remained wet (RW) or temporarily dried (DR) during this period. Prior to flow cessation, taxa and EPT richness were similar between reach types while EPT abundance was higher in DR reaches, which were closer to a perennial source. Desiccation-resistant taxa and flying adults contributed to a rapid rebound in taxa richness in DR reaches within two weeks of flow resumption, while EPT richness recovered gradually over the 5-month period. Recovery patterns for total abundance were similar while EPT abundance did not fully recover during the sampling period. EPT and taxa richness did not vary across time in RW reaches while abundance declined from September-December and increased to a peak in May. These results indicate that an extended recolonization period is required to recover sensitive (EPT) macroinvertebrate assemblages lost during periods of channel drying.

DIRECT AND INDIRECT EFFECT OF EUTROPHICATION ON LAKE ECOSYSTEMS: SUPPORT FOR NUTRIENT CRITERIA DEVELOPMENT

Zheng, Lei; Paul, Michael; Lincoln, Ann

103AB
Tuesday, 19 May, 2015 14:30 - 14:45

Excess nutrient loading is among the most prevalent causes of water quality impairment in the United States. Nutrients affect aquatic systems most directly by increasing algal and macrophyte production and shifting algal and macrophyte species composition, and most indirectly by altering dissolved oxygen (DO) and disrupting the food web. We used a compiled long-term ecological research (LTER) dataset of 1619 lakes in the Northern Lakes and Forests ecoregion of Wisconsin to explore the effect of nutrient enrichment on biological condition of the lake community (zooplankton, invertebrate, and fish assemblages). Although the biological community, especially fish and zooplankton, responded to total nitrogen and phosphorous concentrations, their linkages with hypoxia were less clear. However, hypoxia (DO < 2 mg/L) was strongly related to Chl a concentrations despite spatial and seasonal variations of DO and lake stratification. Furthermore, elevated Chl a concentrations were strongly related to both TP (R2=0.47) and TN (R2 = 0.53), indicating enrichment predicts hypoxia in these lakes. Nutrient criteria can be established based on these direct and indirect relationships to biological communities.

DISPERSAL CAPACITY AND BROAD-SCALE LANDSCAPE STRUCTURE SHAPE BENTHIC INVERTEBRATE COMMUNITIES ALONG STREAM NETWORKS

Li, Fengqing; Tonkin, Jonothan; Haase, Peter

102B
Tuesday, 19 May, 2015 14:30 - 14:45

For river benthic invertebrates it remains unclear how dispersal as a key trait influences species´ distribution patterns and meta-community structure. Based on 1,466 benthic invertebrate samples across Germany we compared dispersal capacity and community dissimilarity between headwaters and mainstems for highland and lowland streams, respectively. Dispersal capacity of benthic invertebrates varied greatly along the stream networks and increased with stream size in both highland and lowland streams. Increasing dispersal capacity from headwaters to mainstems leading to homogenization of communities in highland but not in lowland areas suggests that both dispersal capacity and landscape structure interact to determine community structure in these networks. We interpret these results as indicating a potential species sorting (SS) to mass effect (ME) transition in networks with a gradient in connectivity, but in highly connected environments, these transitions do not occur. Our results therefore stress the importance of considering dispersal traits and landscape features, as well as habitat control to better understand the (meta-)community structure across various landscape types.

NUTRIENT/SEDIMENT RUNOFF AND ECOLOGICAL CONDITION: LINKING THE SWAT-VSA MODEL WITH EMPIRICAL MEASURES

Regan, Claire; Yetter, Susan; Veith, Tameria; Collick, Amy; Brooks, Robert

102C

Tuesday, 19 May, 2015 14:30 - 14:45

Management of nonpoint sources of nutrients and sediments is the primary challenge for improving conditions within the Susquehanna-Chesapeake Basin. While ecological indicators are widely used to assess stream integrity, a direct link between nutrient and sediment stressors and ecological response remains ambiguous. This is partly due to the difficulty of obtaining high-resolution empirical measurements of nutrients and sediments. However, models that simulate runoff can be a more practical option. The Soil and Water Assessment Tool with Variable Source Area Hydrology (SWAT-VSA) is one such model and was recently used in WE38, a small upland agricultural watershed in Pennsylvania that drains into Mahantango Creek. Correlations between ecological condition and nutrient and sediment pollution have been explored by comparing model outputs of nitrate, phosphorus, and sediment with landscape metrics, the Stream-Wetland-Riparian Index, and the Pennsylvania Department of Environmental Protection Index of Biotic Integrity for benthic macroinvertebrates. This research is a key step in linking a promising area of nonpoint management – nutrient and sediment modeling – with the ecological conditions of streams within the Susquehanna-Chesapeake basin.

MACROINVERTEBRATES RESPONSES TO ANTECEDENT FLOWS: HYDRAULICS OR HYDROLOGY?

Barmuta, Leon A.; Hardie, Scott A.; Bobbi, Chris; Warfe, Danielle M.

102D
Tuesday, 19 May, 2015 14:30 - 14:45

Over the last 25 years, researchers have advocated that hydraulics should be more proximal to benthic distributions than gross measures of hydrology. Recent modelling advances allow ecologists to generate hydraulics over defined time periods prior to sampling events, thus overcoming a major criticism of many early studies, viz. that instantaneous hydraulic measures were unlikely to represent what the benthos had experienced in the weeks before sampling. We surveyed and sampled 12 sites in 6 Tasmanian rivers over 5 years with contrasting hydrologies. Habitat-specific hydraulic measures were computed from modelled flows at hourly time steps for each habitat within each site and summarised for seven different time-spans. Quantile regressions showed modest relationships between some hydraulic variables and two flow-related trait groups. Multivariate analyses in trait space found that hydrological variables explained > 3 × the variance of hydraulic variables, but total variance explained was still ca. 50%. So, while coarse hydrology might not be so bad, some stakeholders will be unconvinced by the strength of these relationships. We need to consider carefully the limitations of correlative data sets in these contexts.

COMPARISON OF BENTHOS AND PLANKTON FOR SELECTED AOC AND NON-AOC RIVERS AND HARBORS, WESTERN LAKE MICHIGAN

Scudder Eikenberry, Barbara; Bell, Amanda; Templar, Hayley; Burns, Daniel

103C
Tuesday, 19 May, 2015 14:30 - 14:45

To inform management decisions regarding removal of Beneficial Use Impairments for “Degradation of Benthos” and “Degradation of Plankton” at Wisconsin’s Lake Michigan Areas of Concern (AOCs), benthos and plankton were collected at four AOCs and six non-AOCs during three seasons in 2012 and 2014. The AOCs are the Lower Menominee River, Lower Green Bay—Fox River, Sheboygan River, and Milwaukee Estuary; each AOC was paired with two non-AOCs of similar size and land use. Taxonomic richness, diversity, and Index of Biotic Integrity (IBI, benthic invertebrates only) were compared between an AOC and 1) all non-AOCs for each seasonal sample, 2) two paired non-AOCs for each seasonal sample, and 3) two paired non-AOCs across all seasons. Results indicate the Lower Menominee River AOC was deemed degraded for benthos IBI; Milwaukee Estuary AOC (Milwaukee and Menomonee Rivers) was degraded for benthos IBI and richness; Fox and Milwaukee Rivers were deemed degraded for zooplankton richness. No AOCs were deemed degraded in 2012 for phytoplankton richness or diversity in comparison to non-AOC sites, possibly due to tolerant taxa. We await 2014 data for comparison.

FROM CONCRETE CHANNELS TO RESTORED REACHES: EVALUATING THE ECOLOGICAL STATE OF RE-NATURALIZED STREAMS IN URBAN WATERSHEDS

Levi, Peter S.; Macchiavelli, Sofia I.; McIntyre, Dr. Peter

101CD
Tuesday, 19 May, 2015 14:30 - 14:45

Urban streams are often severely degraded due to channelization, high loads of nutrients and contaminants, and development in the watershed (e.g., impervious surfaces). Channel re-naturalization can improve ecosystem structure and function, but the details of the restoration approach and location within the watershed are likely to mediate the benefits. We quantified metrics of structure and function in restored reaches and contiguous concrete channels of six urban streams in Milwaukee, Wisconsin. The streams spanned gradients in both discharge (15-210 L/s) and watershed position (i.e., headwater to mainstem). Nutrient concentrations were generally high and did not differ between the restored and concrete reaches. However, chlorophyll-a and organic matter were generally higher in the concrete reaches, while transient storage metrics were higher in the restored reaches. Functional metrics, such as whole-stream metabolism and nutrient uptake, did not differ consistently between the reaches, perhaps due to variation in watershed characteristics across the urban landscape. Our research suggests that channel restorations do improve some ecosystem structure and function relative to adjoining concrete channels, but streams cannot be fully restored by re-naturalizing short reaches alone.

IMPACTS OF MOUNTAINTOP REMOVAL MINING AND VALLEY FILLS ON STREAM SALAMANDER OCCUPANCY, ABUNDANCE AND SPECIES RICHNESS

Price, Steven; Muncy, Brenee'; Bonner, Simon; Barton, Chris; Drayer, Andrea

102C
Tuesday, 19 May, 2015 14:45 - 15:00

Across central Appalachia, mountaintop removal mining with valley fills (MTR/VF) is a dominant stressor of stream ecosystems. We examined the effects of MTR/VF on occupancy, abundance and species richness of stream salamanders in southeastern Kentucky. We found mean occupancy (across all species) in MTR/VF streams was 0.50 and mean occupancy in control streams was 0.87 suggesting that salamanders have a higher probability of occupancy in streams that have not been impacted by MTR/VF. Additionally, across all species, estimated mean abundance given occupancy was lower at MTR/VF sites. Furthermore, the mean species richness for MTR/VF streams was 2.27 whereas richness was 4.67 for control streams. Numerous mechanisms may be responsible for decreased occupancy, abundance and species richness at MTR/VF streams, although water chemistry may be particularly important. Indeed, mean specific conductance was 30 times greater, sulfate (SO_4) levels were 70 times greater, and concentrations of dissolved ions (Ca, Mg, K, Na) were greater in MTR/VF streams than in control streams. Our findings suggest that stream salamanders appear to be particularly sensitive to MTR/VF.

BEYOND SPECIES – APPLYING AN ECOSYSTEM TRAIT APPROACH IN BIODIVERSITY RESEARCH AND FRESHWATER CONSERVATION

Gerisch, Michael; Feld, Christian; Hering, Daniel ; Jähnig, Sonja C.; Tockner, Klement

102B
Tuesday, 19 May, 2015 14:45 - 15:00

An ecosystem is a complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space. Ecosystems are connected by spatial flows of energy, material, and organisms, which are important drivers of biodiversity. However, the diversity of ecosystems, i.e. their composition, configuration, and connectivity, is frequently overlooked in biodiversity research and freshwater conservation. This is particularly critical because many restoration projects fail, or do not achieve their goals, because the spatial context of ecosystems is not sufficiently considered. Here, we introduce the concept of ecosystem traits to link inherent properties of ecosystems to species, functional, and genetic diversity at local and regional scales. Ecosystem traits refer to the structural and functional properties of ecosystems. This trait-based approach can be applied to various scales, from an individual habitat to metaecosystems and to entire landscapes. Conceptual and empirical examples will outline the potential applications of ecosystem traits in biodiversity research and freshwater conservation.

ESTIMATION OF INLAND LAKE CHLOROPHYLL A BASED ON LANDSAT TM/ETM+ AND BOOSTED REGRESSION TREES (BRT)

Lin, Shengpan; Qi, Jiaguo; Jones, John; Stevenson, Jan

103AB
Tuesday, 19 May, 2015 14:45 - 15:00

Compared to in-situ water quality measurements, remote sensing observations cover larger areas and longer periods with lower cost. Few algorithms have provided robust Chl estimation over large areas covering multiple satellite overpass paths, or/and one area for a long time period. We applied a new advanced machine learning algorithm (i.e. Boosted Regression Trees, BRT) in Chl estimation. Evaluated by 10-fold cross validation, Landsat TM/ETM+ bands and band ratios together could explain 46.1% and 37.9% of Chl variance measured, respectively, in the first National Lake Assessment (lake number = 1149) across the United States and during a 23-year program monitoring 39 reservoirs in Missouri. The BRT algorithm was slightly affected by sediments and CDOM. Most error is likely related to atmospheric effects, specular reflectance on water surface, and in-situ data that were used in BRT fitting and validation. Our work indicates remote sensing could be a valuable tool for long-term ecological assessments of inland and turbid waters.

INFLUENCES OF DOC ON NITRATE UPTAKE IN SUBURBAN STREAMS

Rodriguez-Cardona, Bianca; McDowell, William H.

101B
Tuesday, 19 May, 2015 14:45 - 15:00

DOC strongly influences N processing in streams but the underlying mechanisms driving the coupled interaction of organic matter quantity and uptake of inorganic nitrogen forms are not well understood. A series of NO3 additions was conducted in four sites within the Lamprey River Watershed (LRW) with a wide range in background DOC (1 - 8 mg C/L) and NO3 (2 – 1160 ug N/L) concentrations from spring through fall in 2013 and 2014. Across all sites and experimental dates, ambient and dynamic uptake velocities (Vf) correlated negatively with NO3 concentrations and positively with increasing DOC concentrations and DOC:NO3 ratios. Individual sites varied in their uptake kinetics, with data suggesting that saturation and efficiency loss models, hysteresis, undetectable uptake, and an increase in Vf with higher NO3 concentrations can all occur. Sites with high DOC and DOC:NO3 were the most efficient at removing NO3 from the water column but demonstrated saturation kinetics; those with high NO3 concentrations were less efficient but did not saturate. NO3 uptake dynamics in the LRW seem to be most influenced by DOC rather than NO3 concentrations.

CYCLES OF BOOM AND BUST IN COASTAL CALIFORNIA INTERMITTENT STREAMS

Bogan, Michael; Leidy, Robert; Carlson, Stephanie

103DE
Tuesday, 19 May, 2015 14:45 - 15:00

Intermittent streams in California experience dramatic cycles of boom and bust across seasons and years. In wet winters these streams have many kilometers of flowing water, whereas in dry seasons or years only small, isolated pools remain. The communities inhabiting these remnant pools are rarely studied and their role in facilitating community recovery in adjacent reaches is unknown. We quantified community composition in remnant pools at one small and one large intermittent coastal stream in California: John West Fork (3km2) and Coyote Creek (240km2). After flow returned, we monitored community development in intermittent reaches adjacent to perennial pools. Both streams supported >150 invertebrate species in remnant pools. Coho salmon and steelhead inhabited pools at John West Fork, and 11 species of native fish and amphibians inhabited pools in Coyote Creek. Early in the wet season, communities in newly-flowing intermittent reaches were dominated by taxa with life stages resistant to drought (e.g. diapause). However, within several months taxa from perennial pools had moved into adjacent intermittent reaches. Our results demonstrate the importance of perennial refuges in maintaining biodiversity in intermittent streams.

SHIFTS IN FISH POPULATION DYNAMICS RELATED TO ENERGY DEVELOPMENT AND HYDROLOGY IN HEADWATER STREAMS OF THE WYOMING RANGE

Walker, Richard; Walters, Annika

101A
Tuesday, 19 May, 2015 14:45 - 15:00

Natural gas development has expanded at an unprecedented rate and our understanding of how stressors associated with these activities affect aquatic ecosystems is limited. Stressors linked to natural gas development are proposed to have negative impacts to stream health unless best management practices are implemented. The objective of the study is to examine whether there have been shifts in fish population dynamics in relation to varying levels of energy development across years with differing hydrologic regimes (2012-2014). Specifically, we examined abundance and size-structure of mottled sculpin (Cottus bairdii), mountain sucker (Catostomus platyrhynchus), and Colorado River cutthroat trout (Oncorhynchus clarki pleuriticus). Very few mottled sculpin and no cutthroat trout were collected from high energy development sites, though mountain suckers had higher abundances. At sites with low energy development, all species exhibited similar oscillating patterns in abundance that are potentially linked to differences in yearly hydrologic regimes. A better understanding of how energy development and hydrology interact to affect fish population dynamics can help guide management of these native fish species.

STREAM WATER AND PERIPHYTON CARBON AND NITROGEN STABLE ISOTOPES INDICATE INSUFFICIENT PROTECTION FROM AGRICULTURAL INFLUENCES

Whorley, Sarah; Wehr, John

103C
Tuesday, 19 May, 2015 14:45 - 15:00

Stable isotopes are increasingly used as indicators of environmental disturbance. We examined the use of d13C and d15N of stream water and periphyton to determine the effectiveness of Best Management Practices (BMPs) used to mitigate agricultural disturbance in headwater streams in NY State. Stream water and periphyton were collected from 20 streams in four categories: recently applied, long-standing BMP treatments, lacking BMPs, and reference streams. Stream water and periphyton were sampled April through November 2013 and analyzed for ?13C and ?15N content. Aqueous and periphytic ?13C in agricultural streams was 13.4% and 12.2%, respectively, greater than in reference streams, with no difference between BMP categories. Average difference of agricultural water ?15N values was 33.9% greater than reference streams, but varied little between BMP categories. Average difference of agricultural periphyton d15N was 48.1% greater than reference periphyton, which indicates elevated N inputs from the landscape, despite BMP presence. These results indicate a significant effect of agriculture on stream water and periphyton biochemical properties, despite BMP mitigation. This study suggests that current agricultural mitigation steps have not been fully effective at remediation.

LINKAGES BETWEEN STREAM FLOW, HABITAT, AND BIOTIC ASSEMBLAGES IN AN URBANIZED LARGE RIVER

Roy, Allison; Jane, Stephen; Finn, John; Hazelton, Peter; Randhir, Timothy; Richards, Todd

102D
Tuesday, 19 May, 2015 14:45 - 15:00

With increased pressure from a growing human population, managers are challenged to understand how novel disturbances (e.g., climate change, increased water withdrawals, urbanization) may affect natural resources. The Sudbury River is a National Wild and Scenic River with myriad impairments (e.g., mainstem impoundments, withdrawals, and urbanization) that is under increasing pressure from hydrologic alteration. In summer 2014, we sampled fishes, mussels, and macroinvertebrates along the main stem, and surveyed channel cross sections and profiles. Analysis of stream gage data indicates a roughly 200% increase in rise rates, an approximate 65% decrease in 1-day minimum flows, and a trend towards increasing high flow pulse counts. The most abundant mussel species collected were the cosmopolitan Eastern elliptio (58%) and Eastern lampmussel (40%). The fish assemblage has shifted from one that should be dominated by fluvial specialist species to one overwhelmingly dominated by macrohabitat generalists (90.6%). Overall, the current fish community has a 22.7% similarity to the target (reference) fish community. This case study demonstrates how a traits-based approach can be used to assess biotic stressors and identify potential for future impairment.

ENVIRONMENTAL DRIVERS OF BENTHIC CYANOBACTERIAL DISTRIBUTION AND TOXIN PRODUCTION IN A RIVER NETWORK

Bouma-Gregson, Keith; Kudela, Raphael; Power, Mary

103AB
Tuesday, 19 May, 2015 15:00 - 15:15

Most cyanobacterial harmful algal blooms occur in estuaries and lakes, but in the Eel River in Northern California benthic cyanobacterial mats have killed 11 dogs in the last decade. In rivers in Mediterranean climates, benthic algae fuel summer aquatic food webs. When algal assemblages tip towards toxic cyanobacteria water quality is degraded, negatively impacting food webs and public safety. During two drought summers, 2013 and 2014, we measured spatial patterns, cyanotoxin concentrations, and abiotic conditions of cyanobacterial mats in the Eel River. Species of Anabaena and Phormidium were the dominant cyanotoxin producers in the watershed. Concentrations of the neurotoxin anatoxin-a were higher than the liver toxin microcystin, and concentrations peaked during mid-summer in warm middle-reaches of the watershed. However, cyanotoxin concentrations varied weekly, suggesting rapid turnover between toxin-producing and non-producing strains. We hypothesize that low river discharge and warm water temperatures associated with droughts increase the abundance of cyanobacteria in the Eel River. Knowledge of environmental conditions that promote cyanobacteria in rivers is needed for management to maintain productive food webs and reduce public health threats from cyanotoxins.

DIEL VARIABILITY IN PREY CAPTURE BY TWO SPECIES OF UTRICULARIA (LENTIBULARIACEAE) FROM SOUTH CAROLINA, USA

DeJong, Grant

103DE
Tuesday, 19 May, 2015 15:30 - 15:45

Bladderworts (Lentibulariaceae: Utricularia) are fascinating carnivorous plants that frequently live in nutrient-poor environments. These plants are famous for the bladder-like traps on their stems, which create a vacuum and suck prey into the bladder when a trigger hair is bumped. I found two abundant species of Utricularia in wilderness areas within the Francis Marion National Forest in South Carolina, and I collected a sample every three hours from 0600 to 2400 on July 7-9, 2014. Bladders were dissected in the lab, from which recovered animals were identified and counted. Number of prey items ranged from 0.20-0.49/bladder, and a diel shift was observed in prey capture intensity in both species, with more prey captured during the day than at night. Peak prey capture occurred three hours earlier in U. gibba than in U. inflata, although both species appeared to be utilizing the same prey base, providing a possible example of ecosystem partitioning between the two species.

THE INFLUENCE OF ANTECEDENT FLOW CONDITIONS ON AQUATIC INVERTEBRATE COMMUNITIES

Greenwood, Michelle; Booker, Doug; Winterbourn, Mike; Smith, Brian

102D
Tuesday, 19 May, 2015 15:30 - 15:45

Defining environmental flow regimes that protect in-stream communities and ecosystem functions requires both an understanding of the role of the hydrological regime in influencing river ecosystems and quantification of these influences. The objectives of this study were to investigate whether aquatic invertebrate communities across New Zealand exhibit consistent responses to antecedent flow conditions and if so, to develop a hydrology-sensitive invertebrate-based index. Using 22 years of data from 66 sites across New Zealand, we identified several common relationships between the time since a flood and invertebrate community composition. A New Zealand specific version of the UK-based LIFE (Lotic-invertebrate Index for Flow Evaluation) index (LIFE-NZ) was then developed and tested against existing local organic-pollution sensitive invertebrate indices. LIFE-NZ was correlated with local water velocity and antecedent flow, while several existing pollution-sensitive indices were also correlated with antecedent flow. Aquatic invertebrate community composition is affected by many factors, thus indices designed to be sensitive to organic pollution or flow regime are unlikely to be entirely independent. However, hydrology-sensitive invertebrate-based indices are an additional tool available when setting environmental flows.

TWO SIDES OF CROSS-ECOSYSTEM SUBSIDY FLUX IN AQUATIC AND TERRESTRIAL HABITATS

Zhang, Yixin; Xiang, Hongyong

101B
Tuesday, 19 May, 2015 15:30 - 15:45

Freshwater and terrestrial ecosystems are closely linked by flux of donor-controlled subsidies - the addition of nutrients and materials (detritus and prey), which not only can affect consumer abundance, but also explain variation in the strength of trophic cascades in food webs. However, while the flux supplies foods for recipient communities to subsidize primary producers and consumers and alter species interactions, harmful contaminants are also propagated to adjacent ecosystems through subsidy movement. In both donor and recipient ecosystems, contaminants cause considerable impacts on ecological processes through damaging ontogenetic development of focal species (e.g. aquatic insects, amphibians), decreasing subsidy quantity and quality, restricting population size of consumers. All of which may fuel a cascade effect and influence ecosystem functioning. Empirical studies have shown that the dynamics and effects of contaminants relating to subsidies can be affected by numerous factors. Future study to examine the influence of subsidies, including contaminant-specific flux, on trophic position of consumers should consider accessing direct and indirect effects of land-use change and global warming on food web structure in recipient habitats, as well as in source habitats.

HOW TO SAVE AN IMPERILED FAUNA IN AN INCREASINGLY THREATENED LANDSCAPE: FROM ENDANGERED SPECIES TO ECOSYSTEM SERVICES

Vaughn, Caryn C.

102E
Tuesday, 19 May, 2015 15:30 - 15:45

Freshwater mussels are one of the world's most imperiled faunas, largely because their life history traits make them highly vulnerable to climate change, habitat destruction and alteration, population fragmentation, and introduction of non-native species. Although most mussel species are declining, much of past work in mussel conservation has focused on documenting and propagating only the rarest species. More recent research has highlighted that while conservation of rare species is important it is the common species that provide the majority of ecosystem services because mussels are "biofilters" that transfer energy and nutrients in aquatic foodwebs and even into terrestrial ecosystems. The biophysical processes performed by mussels vary with species and environmental conditions, particularly flow and temperature. These biophysical processes can be quantified and assigned value as ecosystem services. Further, the social demand for these services can also be assessed and compared, which is particularly important in our increasingly human-dominated landscapes. My lab is using this approach to inform reservoir management and environmental flows in the south central US where extreme droughts are predicted to become more frequent, intense and persistent.

THE HYPORHEIC ZONE AS A PRIMARY SOURCE OF RESILIENCE FOR INVERTEBRATE COMMUNITIES IN INTERMITTENT ALLUVIAL RIVERS: EVIDENCE FROM FIELD AND LABORATORY EXPERIMENTS

Vander Vorste, Ross

102B
Tuesday, 19 May, 2015 15:30 - 15:45

Intermittent rivers, whose flow ceases periodically, represent half of the World's rivers and are expanding in many areas. Understanding community resilience in such systems is essential to predict the effects of climate change on biodiversity. We hypothesized that the hyporheic zone is the primary source of resilience in alluvial rivers and tested this using i. a natural experiment where community resilience to drying was addressed in 8 rivers, ii. a field experiment where flow and sources of resilience were manipulated, and iii. mesocosm experiments that simulated drying events (increased water temperature and competition). Our results indicate that communities in alluvial rivers are highly resilient to drying; recovery within 3 weeks of rewetting was observed in all rivers after drying events lasting 14-105 days. Preventing recolonization by drift did not alter recovery and circumstantial evidence indicates the hyporheic zone is the main source of resilience in alluvial rivers. Both intraspecific competition and increased temperature triggered the active vertical migration of invertebrates into the hyporheic zone. Altogether, these results indicate the hyporheic zone is essential to maintaining biodiversity in intermittent alluvial rivers.

FISH FAT FACTS: OMEGA-3 FATTY ACIDS IN SPORT FISH FROM THE GREAT LAKES BASIN

Williams, Meghan; Schrank, Candy; Murphy, Elizabeth; McCann, Pat; Anderson, Henry

101A
Tuesday, 19 May, 2015 15:30 - 15:45

Partners from the USEPA and the Great Lakes Consortium for Fish Consumption Advisories recently undertook a large-scale, multi-state effort to quantify variations in fatty acid content in wild freshwater fish species that are commonly caught and consumed by anglers and their families. Nearly 900 samples, representing 24 fish species, from the Great Lakes Basin were collected between 2010 and 2013 and analyzed for 37 fatty acid types, including omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Potential contributing factors to variation in species' EPA+DHA content (i.e. size, diet, season, water body characteristics) were also explored. We found that in both inland and Great Lakes waters, piscivorous species contained significantly higher ($P < 0.0001$) EPA+DHA content than those that were wholly or partly benthivorous. Furthermore, across all diet types, fatty acid content generally decreased as the trophic state index increased. In-depth intraspecific variation in fatty acid content will be discussed further. These findings provide insight into ecological controls on fatty acids in wild freshwater fish and may ultimately allow for the development of more comprehensive fish consumption advice.

SEEKING CLARITY: HOW A PUBLIC/PRIVATE PARTNERSHIP INTENDS TO DRAMATICALLY IMPROVE CONDITIONS IN A HISTORICALLY HYPEREUTROPHIC LAKE

Ogdahl, Mary; Steinman, Alan; Weinert, Maggie

102C
Tuesday, 19 May, 2015 15:30 - 15:45

Project Clarity is a large-scale watershed remediation collaboration aimed at dramatically improving water quality in Lake Macatawa, a hypereutrophic lake located in western Michigan (USA). The project involves a multi-faceted, holistic approach that includes wetland restoration, in-stream remediation, Best Management Practices (BMPs), community education, and long-term sustainability. This major endeavor, which will take an estimated 10 years and $12 million to complete, is being undertaken by a partnership between government entities, non-profits, universities, private-sector consultants, and stakeholders. An endowment fund established by private donors ensures the long-term capacity of the project to provide the monitoring, education, and improvements necessary to achieve the water quality goals for Lake Macatawa. Preliminary (pre-restoration) monitoring data from wetland restoration sites and Lake Macatawa confirm 1) the need for sediment and phosphorus reduction in the watershed, 2) year-round hypereutrophic conditions in the lake, and 3) the overall poor ecological health of the system. Once watershed remediation is complete, the project is expected to have many economic, social, and ecological benefits – while achieving the ultimate goal of improved water quality in Lake Macatawa.

BASELINE WATER QUALITY MONITORING IN AN AREA OF SHALE GAS DEVELOPMENT, HORN RIVER BASIN, BRITISH COLUMBIA

Pappas, Sheena; Strachan, Stephanie; Shaw, Pat; Shrimpton, Lana

103C
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Shale gas exploration, development and extraction through hydraulic fracturing is occurring in the remote northeastern corner of British Columbia, Canada, in a geological formation known as the Horn River Basin. Since 2000, the number of gas wells in the area has increased exponentially. Very little water quality information exists for this region making potential impacts to water quality and aquatic ecosystem health from this rapidly expanding industry difficult to assess. This talk will describe a multi-year study which aims to establish baseline water quality and benthic macroinvertebrate community information. The assessment approaches used to develop a regional bioassessment model will also be discussed. The model is intended to serve as a benchmark from which stream condition can be measured as development proceeds. While model development focused on least impacted areas, several sites were chosen in areas of higher well density to investigate potential ecosystem health impacts from shale gas development in the Horn River Basin.

AQUATIC CONNECTIVITY AND HABITAT RESTORATION – FUTURE DIRECTIONS

Struck, Andrew

101CD
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The Ozaukee County Planning and Parks Department is implementing a comprehensive effort to restore aquatic habitat connectivity and improve the ecological function of existing riparian habitats throughout the County portion of the Lake Michigan Basin. Since 2006, the Department's Fish Passage Program and partners have removed or remediated 242 impediments to aquatic organism passage, reconnecting over 130 stream miles ("linear connectivity"). However, historic manipulation of many biologically-significant tributary streams have left significant portions of the channel dredged, straightened, and separated from adjacent floodplains and wetlands. The Department is using GIS-based fish and wildlife decision-support tool to prioritize ongoing and future in-stream and riparian habitat improvement and restoration projects that include stream remeandering, floodplain and wetland reconnection ("lateral connectivity"), and invasive vegetation controls along streams recently made accessible through linear connectivity projects. These efforts represent a holistic approach to enhancing the ecological productivity of aquatic and terrestrial riparian habitat, directly supporting the sustainability and/or population recovery for remnant desirable, native, and/or imperiled species, and provide a logical framework for future ecological restoration efforts throughout the Great Lakes Region.

AGRICULTURE AND NATURAL RESOURCE EXTRACTION INTERACT TO AFFECT DRIVERS OF LEAF DECOMPOSITION

Polaskey, Steven; Entrekin, Sally

102C
Tuesday, 19 May, 2015 15:45 - 16:00

Agriculture and resource extraction can interact to alter in-stream characteristics that change drivers of leaf decomposition. Forest clearing and associated sediment and nutrient runoff can degrade habitat that reduces shredder diversity and biomass, and increases microbial activity. Leaf decomposition was quantified in streams draining three land alteration levels, mostly forested (low), mostly pasture (intermediate), and mostly pasture with natural gas (NG) activity (high), using three sets of six mesh bags in each of nine streams. We predicted decomposition would be fastest in intermediately altered streams from increased microbial activity and shredder redundancy maintaining leaf consumption. Decomposition rates (kdd-1) were 40% faster in streams draining mostly forested versus both pasture and pasture-NG dominated catchments from greater shredder activity and no difference in microbial activity. Shredder biomass positively correlated with less in-stream coarse substrate, while nitrate strongly correlated with NG activity. Low shredder diversity across all land use and undetectable effects of nitrate on microbial activity resulted in unexpected decomposition rates.

WILDFIRE EFFECTS ON STREAM METABOLISM ACROSS GRADIENTS OF FIRE SEVERITY, WATERSHED GEOMORPHOLOGY, AND SPATIAL SCALE

Davis, Emily

102B
Tuesday, 19 May, 2015 15:45 - 16:00

As climate change shifts fire regimes, it is important to understand stream ecosystem responses to fire. How stream metabolism responds remains largely unexplored. We investigated effects of fire severity, watershed geomorphology, and spatial scale on stream ecosystem metabolism in a wilderness watershed of central Idaho. We estimated metabolism using observed dissolved oxygen, temperature, and irradiance to model diel oxygen dynamics in 18 streams varying in fire history and watershed characteristics. We estimated rates of production and respiration, using the P:R ratio as an index of metabolic state. We found that post-fire riparian canopy recovery strongly influences stream metabolic state. Severely burned streams with dense riparian regrowth were heterotrophic, whereas streams with less canopy recovery were autotrophic. Fire's effect on stream metabolic state was highly mediated by watershed geomorphology, with the strongest long-term changes observable in low-order, steep streams. Effect sizes of predictors on metabolic state were strongest at fine spatial scales. These results indicate that the physical habitat template acts as a filter for aquatic ecosystem response to disturbance, and that context must be explicitly quantified when assessing stream responses.

OUR FRESHWATER FUTURES: INTEGRATING ANIMALS AND ECOSYSTEM MODELS

Evans-White, Michelle

102E
Tuesday, 19 May, 2015 15:45 - 16:00

Does aquatic biodiversity loss or homogenization have negative consequences for ecosystem function? How and why does cultural eutrophication (i.e., nutrient enrichment) impact the distribution and abundance of aquatic macrofauna such as invertebrates and fishes? Efforts by freshwater ecologists throughout this field's history have enlightened our understanding of these questions by examining controls on secondary production and by linking energy and element cycling within aquatic biota using a stoichiometric framework. We now understand that food resource amounts and elemental ratios can alter growth and production of aquatic species depending on their particular growth requirements. Further, growth requirements vary across species due to differences in body plan and life history. The difference between the resource elemental ratios and growth-demand elemental ratios can predict the function of species in ecosystems. Our future research endeavors in this area will strive to use and modify these basic frameworks to provide a predictive understanding of the relationship between biodiversity and ecosystem function and the effects of scarce or abundant nutrients on animals in ecosystems.

HABITAT COMPLEMENTARITY OF INTRODUCED FLATHEAD CATFISH (PYLODICTIS OLIVARIS) AND THEIR POTENTIAL IMPACT ON NATIVE FISHES IN THE UPPER GILA RIVER BASIN, NM.

Hedden, Skyler; Gido, Keith

101A
Tuesday, 19 May, 2015 15:45 - 16:00

Flathead catfish are ferocious piscivores that have been introduced throughout North America, sometimes into waters where native fishes have no evolutionary history with a top fish predator. This has led to the need for more research on the basic ecology of introduced populations of flathead catfish to understand their impacts on native communities. Flathead catfish in the Gila River, New Mexico were implanted with radio transmitters to assess habitat complementarity at seasonal and daily temporal scales. Results from June 2014 to March 2015 indicate seasonal movement was variable among individuals (0m-42,840m) but approximately two thirds of individuals moved less than 200m from initial tagging location, despite variable stream discharge. Nightly movement to presumed feeding locations was common, but never exceeded 70m. Movement behaviors of this organism have helped parameterize preliminary bioenergetics models to estimate consumptive demands for flathead catfish to range from 1,686 g/yr to 4,600 g/yr, depending on size.

PREDATION STRUCTURED ODONATA ASSEMBLAGES IN FISHLESS, SALMONID, AND CENTRARCHID PONDS IN MAINE

Schilling, Emily

103DE
Tuesday, 19 May, 2015 15:45 - 16:00

Predation is recognized as a strong determinant of lentic invertebrate community structure, and considerable attention has been focused on effects of insectivorous fish species on Odonata assemblages. Our goal was to clarify the effects of different fish predators on the local distribution of damselflies (Zygoptera) and dragonflies (Anisoptera). We surveyed odonate assemblages in ponds in eastern Maine with three different fish predation regimes - fishless, salmonid-dominated or centrarchid-dominated. Three belt transects were established in littoral macrophyte zones at each study pond, and adult Zygoptera and larval Anisoptera were sampled in each transect during two survey periods. Environmental characteristics were similar between fishless and fish-containing ponds, although fishless ponds were slightly more acidic. Odonate species richness and total abundance were similar among the three pond types, but significant differences in species assemblages existed among pond types for both suborders. Zygoptera assemblages differed between fishless and fish-containing ponds, while being similar between salmonid and centrarchid ponds. Anisoptera assemblages differed among the three pond types. These results have implications for conservation of Odonata in aquatic systems managed for recreational fishing.

CHANGES IN STREAM CONDITIONS DURING A MUNICIPAL WASTEWATER RELEASE AND ASSOCIATED EFFECTS ON STREAM METABOLISM

Chesworth, Chris; Culp, Joseph; Chambers, Patricia; Brua, Robert; Yates, Adam

103C
Tuesday, 19 May, 2015 15:45 - 16:00

Rural communities often use wastewater lagoons to treat sewage, however, the effects of lagoons on chemical, physical and ecological conditions of receiving streams are not well described. The goals of this study were to: 1) compare physico-chemical conditions upstream and downstream of a lagoon outfall before, during and after a wastewater release; and 2) assess the association between physico-chemical changes and stream metabolism downstream of the lagoon outfall. Nutrients, flow, average stream depth, pH, conductivity, temperature and turbidity were measured daily upstream and downstream of a lagoon outfall in a small stream near Winnipeg, Manitoba, Canada. Stream metabolism metrics (GPP, ER, NEM) were calculated daily using the open system, single station method at the downstream site. Results showed a significant difference in all parameters except temperature ($p<0.05$) between the downstream site during the release period and all other periods at both sites. We expect that increases in GPP during the discharge are associated with increases in nutrients and decreases in turbidity. This study will provide information to lagoon managers to help mitigate the impacts of wastewater on downstream ecosystems.

ADVANCING FISH PASSAGE IN THE MENOMONEE RIVER WATERSHED

Nenn, Cheryl

101CD
Tuesday, 19 May, 2015 15:45 - 16:00

The goal of the Menomonee River Fish Passage Program is to identify, prioritize, and address fish passage impediments and to improve aquatic habitat in the Menomonee River Watershed in Southeast Wisconsin. Milwaukee Riverkeeper identified and assessed over 382 potential stream impediments, and suspects 126 to be potential barriers to fish passage. In addition, 75 areas of promising spawning habitat were identified along the natural mainstem and tributary reaches that could provide access to floodplain or wetland habitat that could be used for fish spawning or rearing. Removing artificial barriers to aquatic life passage will increase access for Lake Michigan and other native fish to reach spawning habitats. Milwaukee Riverkeeper is working with local municipalities, counties, and private landowners to educate them about identified fish passage impediments and to partner on stream restoration projects. Riverkeeper is working with consultants to help design, fundraise for, and implement high priority culvert replacements/retrofits and restoration projects. Funding has also been received to engage volunteers to remove human debris, trash, fallen bridges, fords, and rock fill that are impeding flow and movement of aquatic organisms.

ASSESSMENT OF MACROINVERTEBRATE TRAIT AFFINITIES ALONG A GRADIENT OF STREAMFLOW PERMANENCE IN THE XERIC REGION OF CALIFORNIA, USA

May, Jason; Carlisle, Daren; Brown, Larry R.; Mazor, Raphael D.; Stein, Eric; Rehn, Andrew C.

102D
Tuesday, 19 May, 2015 15:45 - 16:00

Understanding biotic community distributions and dynamics along a gradient of streamflow permanence is important for conservation of biodiversity. We sampled macroinvertebrate assemblages at 27 streams in April 2014, in the Xeric Region of California, USA. Streams ranged from perennial to intermittent sites and had a median of 162 zero-flow days per year. We analyzed 58 macroinvertebrate traits on both a richness and abundance basis. Traits were analyzed as subsets characterized as life history, mobility, morphology, and ecology. We constructed traits space-resemblance matrices and tested for association with groups of environmental factors characterized as water chemistry, stream habitat, and stream flow metrics. Abundance-based traits generally had stronger associations with environmental factors compared to richness-based traits. No significant relations were found with water chemistry for either abundance- or richness-based traits. Abundance-based traits of life history, mobility, morphology, and ecology had significant relations with stream-flow metrics, and excluding ecology, all the same traits were significantly related to habitat variables. Understanding the trait relations to environmental factors is vital for protecting and conserving biodiversity in intermittent streams within arid regions of the world.

CHEMICAL SPECIATION OF PHOSPHORUS IN THE WATER COLUMN AND SEDIMENT IN GREEN BAY

Lin, Peng; Klump, Val; Guo, Laodong

101B
Tuesday, 19 May, 2015 15:45 - 16:00

Water and sediment samples were collected from Green Bay, Lake Michigan, during August 2014 to examine the dynamics of phosphorus (P) species and their transformation between dissolved and particulate, organic and inorganic phases. Particulate-P in suspended-particles and sediments were further fractionated into five phases using sequential extractions. Predominance and near-anthropogenic level (<1000 nM) of phosphate in the dissolved P pool was observed in the Fox River, while predominance of dissolved organic P and low DIP (22 ± 14 nM) were measured in Green Bay. Within the suspended particulate P, >50% was potentially bio-reactive P. Comparable bio-reactive P fraction was observed for particle-adsorbed P (32%) and phosphorus-bearing iron oxyhydroxides (29%). However, increased detrital-P and decreased bio-reactive P from surface waters to sediments were observed, indicating active particulate-P regeneration in the water column. Low abundance of iron-bound-P in sediments and higher phosphate in bottom waters likely reflected the influence of hypoxia conditions in Green Bay. Most of P was buried and accumulated in sediments mainly as iron-bound and authigenic-P in north of the Bay, but as organic-P off the Sturgeon Bay.

OVERLAP IN THE DIETS OF FOUR SYMPATRIC GAR SPECIES OF WESTERN KENTUCKY

Richardson, Bradley; Flinn, Michael

101A
Tuesday, 19 May, 2015 16:00 - 16:15

During the past decade, increased efforts to reintroduce alligator gar (Atractosteus spatula) to the Lower Mississippi River basin have resulted in the early success of low density populations. To ensure sustainable populations of alligator gar, continued monitoring is critical. The reintroduction of alligator gar to western Kentucky, places the species into a system from which it was absent for more than 50 years and occupied by three other native gar species: longnose gar (Lepisosteus osseus), shortnose gar (L. platostomus), and spotted gar (L. oculatus). The objective is to compare diets of these four species within Clarks River, Kentucky. Prey items were collected from stomachs and identified to lowest taxonomic resolution possible. Fish prey were comprised primarily of shad (Clupeidae), freshwater drum (Sciaenidae), and sunfishes (Centrarchidae); a number of macroinvertebrates were also found in the stomach contents. Longnose gar were found to be the most specialized of the gar species. The interactions of these sympatric gar species and their prey are important for reintroduction success and efforts for alligator gar in western Kentucky.

A BRIEF HISTORY OF STREAM FISH ECOLOGY AND A SPECULATIVE LOOK FORWARD

Freeman, Mary

102E
Tuesday, 19 May, 2015 16:00 - 16:15

Freshwater fishes surprisingly compose >40% of all fish diversity, far more than the proportional availability of fresh to salt water. The variety of fishes inhabiting flowing waters, from small headwater streams to great rivers, has long inspired study. Stream fish ecologists have pioneered research on how habitat and species interactions influence variation in community composition, in space and time. Studies of migration and dispersal have illuminated fishes as linkages within diverse landscapes. As landscapes and river systems have been increasingly altered to meet other human needs, studies have focused on understanding fish population responses to water diversions and dams, and urban and agricultural land use. Research on stream fishes entails interesting challenges in quantifying populations that are difficult to observe directly, and future work is likely to employ novel methods and technologies for detecting species and tracking populations in relation to environmental change. There is a wide scope for future discoveries concerning resilience (or less optimistically, demise) of stream fishes in our changing world, and consequences for ecological function in stream ecosystems.

FROM THE BENTHOS, BOTTOM-UP TO PHYTOPLANKTON: DECOMPOSITION HAS BEEN TRUMPED BY EXCRETION OF N AND P IN MODERN LAKE MICHIGAN

Aguilar, Carmen; Cuhel, Russell

101B
Tuesday, 19 May, 2015 16:00 - 16:15

In Lake Michigan, sedimentation and diagenesis resulted in diffuse flux through a sediment surface layer; a biogeochemical gauntlet for labile chemical species. Since Quagga Mussel benthification after 2003, and subsequent shift from diatoms to picocyanobacterial dominance, particles have been intercepted prior to burial and digestion-excretion is now a dominant benthic process. Its regeneration of phytoplankton growth nutrients is very rapid (1 (P) to 20 (N) nmol/animal/hr), and more importantly subverts biogeochemical speciation controls at the sediment-water interface. Excretion varies systematically with location in a seemingly resource-delivery proportionality. The mmol or more from 30,000 QM per square meter per day is a substantial return of resources to the water. As the flux is supplemented by autolysis in aging individuals, further return may now be coming to the ecosystem. Quagga mussel excretion rates were measured in transects across a seamount-like bathymetric feature in south-central Lake Michigan. On the upstream side of Northeast Reef, where freshly advected bottom water flows across mussel communities, excretion rates are about 0.8 and 31 nmol/animal/hr (SRP and NH_4 respectively) for robust young adult mussels 15-20mm in length.

ANALYSIS OF CHIRONOMIDAE (INSECTA: DIPTERA) DIVERSITY AND COMMUNITY COMPOSITION IN BROWN COUNTY, SD

Roberts, Nathan; Anderson, Alyssa

103C
Tuesday, 19 May, 2015 16:00 - 16:15

Inputs from agricultural runoff can impact aquatic habitats and fauna, often resulting in ecological degradation of waterways. Here, we use Chironomidae (Diptera) to assess agricultural impacts on aquatic systems. Specific goals included: 1.) assessing Chironomidae diversity in two South Dakota river systems, and 2.) correlating these data to land use patterns and water chemistry. Six sites with varying degrees of agricultural impact were selected on the Elm and James Rivers and Chironomidae diversity and richness was assessed monthly from June to October 2014 by collecting surface floating pupal exuviae; water chemistry data were also collected weekly during this period. Chironomidae samples were sorted and identified to genus and diversity and similarity indices were used to compare species composition across sample sites. To date, 23 genera have been identified across all sample sites, with Glyptotendipes as the only taxon common to all sites. The outcome of these results will provide information concerning the health and diversity of these river systems, particularly as it relates to agricultural impacts.

LAKE MICHIGAN DIRECT DRAINAGE RAVINE STREAMS IN EASTERN WISCONSIN: REMARKABLE HABITAT IN FORGOTTEN PLACES

Buser, Dale

101CD
Tuesday, 19 May, 2015 16:00 - 16:15

Much of the west shore of Lake Michigan is flanked by steep bluffs drained by short, naturally incised, streams. Land use changes and industrialization degraded most "ravine" streams. Nevertheless, ravine streams are well recognized for unique plant communities and act as natural corridors and refuge areas in intensely developed landscapes. What has not been widely appreciated is that many ravine streams offer regionally unique and important aquatic habitat attributes: attributes such as cold water, high gradient, coarse-grained substrate, copious groundwater discharge, reliable baseflow, and historical access to Lake Michigan. Mineral Springs Creek in Ozaukee County is a typical ravine stream. Bed morphology, watershed conditions, and water quality were heavily influenced by humans. Nevertheless, the creek maintains a reasonably stable, high-gradient granular bed, relatively cold and reliable baseflow, and hosts disproportionally large runs of salmonids. This presentation briefly examines what makes ravine stream unique and uses Mineral Springs Creek as a case in point. Ongoing challenges and opportunities are discussed. Finally, restoration projects sponsored by Ozaukee County and its partners to restore the stream's unique habitat function are described.

USING ODONATE EXUVIAE TO DETERMINE POPULATION SEX RATIO AND SEXUAL DIMORPHISM IN BODY SIZE AT EMERGENCE

O'Malley, Zoe; Orlofske, Jessica; Monk, Wendy; Curry, Allen

102D
Tuesday, 19 May, 2015 16:00 - 16:15

Odonate life histories are intricately tied with the water as well as land, especially during the critical transition from nymph to adult. Understanding the relationship between flow, habitat connectivity and habitat sustainability is key to the development of sustainable management strategies for species of interest. The purpose of this study was to determine the population sex ratio and the relative body size of each sex at emergence for several Odonate species using exuviae. We collected exuviae over 21 days in May and June 2014 from 12 sites near Grand Lake and along the Saint John River in New Brunswick, Canada. Over 2000 exuviae were collected and represent at least 27 species of Odonata. The most abundant species of which were Cobra Clubtail (Gomphus vastus). Using exuviae we can examine Odonate populations without collecting adult individuals, which is important for studying the Skillet Clubtail (Gomphus ventricosus), a local species at risk. Examining the sex ratio and sexual dimorphism in body size at emergence can provide valuable information about the population dynamics and life histories of Odonate species.

USING BIOMASS SPECTRA TO QUANTIFY FISH AND MACROINVERTEBRATE COMMUNITY STRUCTURE IN SOUTHERN WEST VIRGINIA STREAMS

Kirk, Andrew; McGarvey, Daniel

103DE
Tuesday, 19 May, 2015 16:00 - 16:15

Quarterly fish and macroinvertebrate data, including population abundance and biomass, were collected in three wadeable, southern West Virginia streams. Study objectives were to characterize the natural history of a historically understudied region and to test the applicability of biomass spectrum analysis—the negative relationship between average individual biomass within binned mass categories and the total standing stock biomass of a given size interval—in small streams. Biomass spectra have been rigorously documented in lake and marine ecosystems but are rarely examined in lotic systems. We estimated fish abundances using 3-pass electrofishing depletion surveys, with all fishes identified and weighed. Macroinvertebrates were collected from riffles and runs with a Hess Sampler, preserved and returned to the lab for identification, and published length-mass regressions used to estimate individual biomass. Preliminary analyses of combined fish and macroinvertebrate data suggest that biomass spectra in our study streams are nearly identical to published lake spectra, with characteristic slopes of approximately -1.0. This suggests that the distribution of individual and total biomass in lotic and lentic ecosystems may be subject to similar regulatory mechanisms.

AGRICULTURAL LANDSCAPES AND EFFECTS OF PESTICIDES IN TROPICAL HIGHLY BIODIVERSE STREAMS OF THE ECUADORIAN CHOCO

Morabowen, Andres; Rios-Touma, Blanca

102C
Tuesday, 19 May, 2015 16:00 - 16:15

The consequences of urban and agricultural land uses in Ecuador at ecosystem level are not fully studied. There is a strong conflict between the conservation of highly diverse ecosystems and economically important productive areas. The current agricultural practices involve extensive use of pesticides, which effects on the ecosystem are not yet understood in tropical streams. To understand the effect of widespread used pesticides in tropical rivers of Ecuador, we studied streams in three different land uses: Pristine montane rainforest, organic farms that included forest patches, and Palmito (Euterpe edulis) harvested lands (with extensive use of Endosulfan used as insecticide, and Glyphosate a herbicide). We studied three streams at each land use. We took quantitative and qualitative macroinvertebrate samples, periphyton quantitative samples, measure sediment, physic-chemical variables and quantified the presence of pesticides used in Palmito farmlands. Our results show a direct relationship between the decline of certain macroinvertebrate groups (e.g. Anacroneuria, Leptonema and Campylocia) and the use of pesticides. Furthermore we found that the diversity losses in the streams crossing organic farms are negligible at macroinvertebrate and periphyton level.

EFFECTS OF EXPERIMENTAL WATER ABSTRACTION ON INSTREAM PROPERTIES AND INVERTEBRATE ASSEMBLAGES IN TWO LOWLAND STREAMS

Garcia, Liliana; Pardo, Isabel

102B
Tuesday, 19 May, 2015 16:00 - 16:15

We used a controlled experiment to evaluate short-term ecosystem responses to flow and water reduction in two lowland streams. Weekly and biweekly samples of both abiotic and biotic stream components were taken both before and after the experimental reduction at the control (upstream) and disturbed (i.e. stagnant and drought) stretches. Flow reduction was complete at both stretches, causing a stronger water reduction in the drought treatment. There was a significant overall effect of disturbance on both stream components in comparison with upstream controls. The responses of the macroinvertebrate communities differed between streams and within stretches. In one stream, invertebrate densities declined relative to the control (up to 74% of the total invertebrates and 91% of the EPT) but only in the stagnant stretch. On the other, there was a strong decline in invertebrate richness in the stagnant stretch (up to 22% and 49% of the EPT, respectively), and on EPT richness (up to 66%) in the drought stretch. Lowland streams are extremely vulnerable to climate change and anthropogenic impacts for their hydrological position and closeness to human populations.

THE RESPONSE OF MUSSEL POPULATIONS TO THE ADDITION OF SALINE WATER FROM A CLOSED BASIN LAKE INTO THE SHEYENNE RIVER OF NORTH DAKOTA

DeLorme, Andre; Wieland, Louis

102B
Tuesday, 19 May, 2015 16:15 - 16:30

Devils Lake, a closed basin lake, has seen an eight meter rise in water elevation in the last 20 years. To alleviate flooding two outlets were opened to drain water from the lake into the Sheyenne River. This has resulted in higher, constant flow regimes over the summer and fall, and markedly higher levels of ions such as sulfate and chloride in the Sheyenne River. In comparing mussel populations at three sites before and after opening of the outlets, overall mussel populations decreased by an average of 70%. We saw a pattern of greater decreases in certain species and less of an effect on others. The Wabash Pigtoe (Fusconaia flava) saw a decrease ranging from 74% to 99%. This species has gone from the most common species collected in that section of the river to one of the rarer species. In contrast the Black Sandshell (Ligumia recta) has shown a steady population level over the years of sampling. Further biota studies to examine the impact of Devils Lake water on the Sheyenne River are warranted.

OUR FRESHWATER FUTURE AND THE IMPORTANCE OF FISH SPECIES FOR THE FUNCTIONING OF STREAM ECOSYSTEMS

Flecker, Alexander; Capps, Krista

102E
Tuesday, 19 May, 2015 16:15 - 16:30

Freshwater conservation requires an understanding of the role of species for the functioning of aquatic ecosystems. Species losses and additions (i.e. invasions) are compromising the future of freshwaters as we know them – not only from the perspective of biodiversity but also in terms of the ways ecosystems work. Using studies on tropical fishes, we explore the importance of species on ecosystem processes, and how species losses and additions can reconfigure ecosystems. Research on migratory fishes in the Orinoco and Amazon Basins illustrates their substantial roles for the cycling of nutrients and materials, in addition to ecosystem processes such as seed dispersal. Likewise, our work in southern Mexico shows that species invasions can have large ecosystem consequences, as observed for armored catfish (Loricariidae). Armored catfish are stoichiometrically unique species that have been introduced via the aquarium trade and can form massive aggregations. In addition to devastating once thriving fisheries, armored catfish sequester large amounts of phosphorus in nutrient poor streams and represent significant biogeochemical hotspots. We discuss the critical need to link species to ecosystems for forecasting our freshwater future.

USING BLOOD HYDROGEN ISOTOPE (Δ 2H) MEASUREMENTS OF LAKE STURGEON (ACIPENSER FLUVESCENS) FOR TRACKING MOVEMENTS AND MANAGEMENT.

Phillips, Iain; Hobson, Keith

102D
Tuesday, 19 May, 2015 16:15 - 16:30

Lake Sturgeon are native to many North American lake and river systems, yet their range has diminished considerably. As part of their recovery, it is necessary to find methods of informing dam-related flow management in order to mitigate the impact of hydroelectric power generation has on this species. Lake Sturgeon are endemic to the Saskatchewan River system but move in waters that differ in isotopic composition. We used a field study and a lab experiment to determine both migration history and timing since migration based on stable hydrogen isotope ?? 2H? in the blood of lake sturgeon. Isotopic determination of lake sturgeon migration routes were consistent with the results of co-occurring radio-telemetry studies, and blood ? 2H values were a function of environmental water exposure and not diet. We describe a new tool to track fish migrations cheaply and less invasively than telemetry for cases where fish move among isotopically different waters. Further, we outline how to apply these results to a inform in-stream flow regimes downstream of Northern Great Plains large hydroelectric facilities.

SHOULD THEY STAY OR SHOULD THEY GO? THE INTERACTIVE INFLUENCE OF HABITAT COMPLEXITY AND CONNECTIVITY ON PREY CONSUMPTION AND COMPETITION IN DRAGONFLY LARVAE AND FISH.

Pitcher, Kristopher; Soluk, Daniel

103DE
Tuesday, 19 May, 2015 16:15 - 16:30

Structural habitat complexity (SHC) and patch connectivity (PC) effect predator-prey interactions and exert a strong influence on community structure/dynamics in terrestrial and aquatic ecosystems. Although these factors vary simultaneously in most systems, their interactive effects are poorly understood. Using pond mesocosms, we manipulated plant density (SHC: low, high) and between patch distance (PC: short, long) in a full factorial design to test their interactive effect on predation by larval dragonflies and fish. In the low/short treatment Anax junius consumed more amphipods (62%±8.7) compared to the low/long treatment (36%±4.8;$p=0.05$). Lepomis spp. consumed more larval damselflies in the high/short treatment (72%±4.9) compared to the low/short treatment (46%±8.1;$p<0.01$). Interference competition occurred at low SHC for snail consumption (23%±3.4 actual vs 47%±4.3 expected;$p<0.01$). Results suggest SHC and PC interactively influence predator foraging behavior depending on the predator/prey combination, but interspecific competition between these predators is only influenced by SHC. This study indicates that SHC and PC should be considered in combination because their influence is synergistic in many aquatic communities, altering predator foraging behavior and changing predator/prey dynamics in complex ways.

NUTRIENT FRACTIONATION AND STREAM FLOW FROM AGRICULTURAL WATERSHEDS IN RELATION TO LANDUSE

Rattan, Kim J.; Chambers, Patricia; Culp, Joseph; Yates, Adam

102C
Tuesday, 19 May, 2015 16:15 - 16:30

Temporal and spatial trends in phosphorus (P) and nitrogen (N) fractions were examined in 10 sub-watersheds of the Red River Valley, Manitoba, Canada, to identify critical factors affecting nutrient export in relation to human activity. Discharge showed a strong seasonal pattern of high discharge during snowmelt, low discharge with rainfall-induced peaks during summer and fall, and low or no discharge during winter. Dissolved P and N showed highest concentrations and loads during snowmelt for all three sampling years (2010, 2013, and 2014), with the exception of occasional summer peaks associated with rain events and wastewater lagoon discharge. Streamwater concentrations of dissolved P and N were significantly correlated ($p<0.05$) with % agricultural land cover and the proportion of land to which fertilizer was applied. Additionally, partial least squares regression analysis indicated that the critical water quality factors affecting water chemistry were land use and hydrology. Our research identified critical drivers of stream-water dissolved nutrients, providing the foundation for modeling nutrient losses and developing effective land use practices to minimize export of bioavailable nutrients

HABITAT ENHANCEMENT OF A LOW GRADIENT MIDWESTERN STREAM

Wentzel, Beth

101CD
Tuesday, 19 May, 2015 16:15 - 16:30

The Ulao Creek Habitat Enhancement Project is a large scale (1.4 mi) stream remeander and floodplain reconnection project conceived by the Ozaukee County Fish Passage Program and the Ulao Creek Partnership and designed by Inter-Fluve. It was designed in 2013 and the first 2 phases of the project were constructed in 2014. This presentation will include a description of the project with emphasis on evaluation of floodplain connectivity, channel geometry analysis and design, incorporation of installed large woody debris to increase habitat complexity, and provision for long term woody debris recruitment.

POPULATION AND INDIVIDUAL INTRASPECIFIC VARIATION IN TRINIDADIAN GUPPIES

Marques, Piata; Takahashi, Talita; Warbanski, Misha; Phillip, Dawn; El-Sabaawi, Rana; Frauendorf, Therese C.

101A
Tuesday, 19 May, 2015 16:15 - 16:30

This study examines variations in diet and feeding morphology of the guppy Poecilia reticulata, Peters, 1859, at both population and individual levels. The guppies were captured in Trinidad & Tobago - West Indies - in reaches of high (HP) and low (LP) predation pressure. Each individual guppy was analyzed for gut contents, and jaw (maxilla) shape. Our results suggest that at the population level, HP guppies feed mostly on aquatic insects (54%) while LP guppies feed on algae (64%). At the individual level, within a population, HP guppies are generalist consumers ($p>0,05$), feeding mostly on aquatic insects, while LP guppies are specialists ($p=0,001$), meaning that each individual within the population feeds on a different food source. The mean maxilla shape was significantly different between populations ($F= 2.86$; $df= 14$; $p<0,01$). LP guppies have broader maxilla than HP guppies. Diet and maxilla shape are correlated within the LP population ($F= 16.3$; $df=19$; $p<0,01$). Our data suggest that guppies can alter intraspecific trait diversity among and within populations.

ANALYSIS OF INCREASING TAXA TRENDS OF LONG-TERM DATA COLLECTED IN MINING IMPACTED STREAMS

Shanteau, Jennifer; DeJong, Grant; Lynch, Jeniffer

103C
Tuesday, 19 May, 2015 16:15 - 16:30

Very few studies have been conducted using consistent long-term data of benthic macroinvertebrate communities. Long-term annual monitoring of sites in Colorado and Idaho by GEI Consultants, Inc. have yielded similar increasing trends in the number of taxa collected both upstream and downstream of mining activities. A preliminary evaluation of the data from four streams, three in Idaho and one in Colorado, suggested that there was no single contributing factor for these trends and further in-depth analysis was required. In order to focus on determining the potential factors contributing to the increasing trends observed, we analyzed a variety of macroinvertebrate metrics, including functional feeding groups, flow and temperature preferences, and pollution tolerances, as well as year-to-year taxonomic similarity, species turnover, and population changes for individual taxa.

TRANSPORT DYNAMICS OF DISSOLVED AND PARTICULATE NUTRIENTS IN RESPONSE TO WOOD ADDITIONS WITHIN AN AGRICULTURALLY IMPACTED STREAM

Drummond, Jen; Wright-Stow, Aslan; Franklin, Paul; Quinn, John; Packman, Aaron

101B
Tuesday, 19 May, 2015 16:15 - 16:30

Wood is a key component in forested streams, playing an important ecological and physical role in creating step-pool profiles, enhancing habitat heterogeneity, retaining organic matter, and changing water velocity. Wood additions can increase in-stream residence times by slowing water velocities and providing high depositional areas for fine particles (i.e. particulate nutrients C, N, P). Thus, wood additions may create biogeochemical hotspots in streams that allow greater potential for local nutrient cycling and processing. The objectives of this research were to determine if added wood enhances in-stream heterogeneity, results in more complex flow paths, increases natural retention of further organic matter and changes geomorphic characteristics of the stream reach. We conducted a conservative solute and fluorescent fine particle tracer injection study in an agriculturally impacted stream with wood additions in the Whatawhata catchment, North Island of New Zealand. Fine particles were analyzed within the surface water and in situ in sediment and biofilms on cobbles throughout the stream reach following the injection. We found that the addition of wood enhanced hydraulic complexity and increased the retention of solute and fine particles.

DO ANNUAL WINTER LAKE DRAWDOWNS ALTER THE PHYSICAL HABITAT STRUCTURE AND COMPLEXITY OF SHALLOW LITTORAL ZONES?

Carmignani, Jason; Roy, Allison

102B
Tuesday, 19 May, 2015 16:30 - 16:45

Annual wintertime water level drawdowns are a common lake and pond management tool implemented across the northeastern US to protect human-built structures and to reduce submerged aquatic vegetation. Despite its widespread use, ecological responses to winter drawdowns are understudied. We quantified physical habitat structure and complexity in the littoral zones of 14 lakes that range in historical drawdown amplitudes (0.3–2.4 m) and two lakes without drawdowns. In each waterbody, we sampled macrophytes, wood, and sediment texture at two 20-m sites adjacent to either forested or developed riparian zones. Our preliminary results indicate that macrophyte biomass and biovolume decreased and substrate heterogeneity increased with amplitude regardless of riparian zone land cover. However, macrophyte structural complexity, small wood density, and leaf litter cover showed no discernible trend. Generally, waterbodies with drawdowns less than 1.5 m varied widely in habitat structure and complexity, suggesting that low-amplitude drawdowns may not consistently alter littoral habitat. Future studies relating metrics of littoral zone physical habitat complexity to biotic assemblages will help determine ecosystem stability and resiliency in response to changes in winter drawdown regimes.

WHAT IS FUELING THE “RING OF FIRE”?

Waples, James; Klump, Val

101B
Tuesday, 19 May, 2015 16:30 - 16:45

Benthic macro-invertebrates are often found in higher densities in the nearshore (shelf and slope) of the Laurentian Great Lakes. However, the flux and source of energy that supports this elevated population of invertebrates is not well defined. In this study, particulate phosphorus and organic carbon fluxes to the nearshore lakebed are measured using the naturally occurring radionuclides thorium-234 (half-life: 24.1 days) and yttrium-90 (half-life: 2.7 days). Large fluxes of P and C suggest that benthic macro-invertebrates in the nearshore are supported primarily by offshore pelagic production.

BENTHIC INVERTEBRATE ASSESSMENT OF THE FRASER RIVER BASIN OVER A 20 YEAR PERIOD (1994-2013) USING CABIN

Strachan, Stephanie; Edwards, Morgan; Pappas, Sheena

103C
Tuesday, 19 May, 2015 16:30 - 16:45

Biological monitoring and assessment using benthic invertebrate communities following the CABIN protocol has been ongoing in the Fraser River Basin since 1994. Since that time, reference condition models have been revised as new sites were sampled or sites were revisited to incorporate temporal variation. The Fraser Basin is significant because it has been said to support the most productive salmon fishery in the world. A federal judicial inquiry was announced in reaction to the record decline of sockeye populations returning to the Fraser River in 2009. In 2012, the Cohen Commission found “no smoking gun” to the Sockeye Salmon decline. In response to the Cohen Commission, this study compiled 20 years of benthic invertebrate monitoring and assessment data in the Fraser Basin to investigate temporal changes in stream condition during the period of decline. Benthic invertebrate communities reflect cumulative impacts represented by habitat degradation or poor water quality over relatively long periods of time. This data compilation identifies areas of the basin showing the greatest cumulative effects to aquatic health and where future monitoring efforts should focus.

ECOTONE PROXIMITY AND ITS INFLUENCE ON PREDATION RISK IN A DYNAMIC WETLAND

Bush, Mike

103DE
Tuesday, 19 May, 2015 16:30 - 16:45

Ecotones exhibit increased use by animals due to nutrient dynamics and ease of travel. The Everglades, Florida, USA, is a freshwater marsh with seasonal rainfall. Aquatic animals move across landscapes during marsh reflooding and move to deepwater refuges during water recession. In the present-day Everglades, refuges are often drainage canals that are structurally barren compared to vegetated marshes. Animal use of canals and canal-marsh ecotones is important because restoration efforts may include filling canals. Electroshocking surveys revealed more piscivores near/in canals (2.9 fish/transect) than far from canals (1.2 fish/transect). A series of 1-m2 mesh cage pairs were deployed near and far from a canal. Cages included an exclosure treatment that served as refuge for small animals from large predators and an open "control" cage accessible to all animals. For small fishes, we found evidence of predator-aversion behavior in both habitats ($p<0.05$), but no evidence of habitat-specific behavior ($p=0.72$). We observed habitat-specific predator aversion behavior ($p=0.05$) for grass shrimp, with higher density in near-canal exclosure cages than controls, but not in marsh cages.

MORPHOLOGICAL VARIATION IN CAMPOSTOMA ANOMALUM ACROSS HYDROLOGIC REGIMES.

Bruckerhoff, Lindsey; Magoulick, Daniel

102D
Tuesday, 19 May, 2015 16:30 - 16:45

Environmental heterogeneity in streams is largely determined by hydrologic regimes. Because hydrology controls many attributes of the physical environment, organisms adapt and evolve in response to maintained hydrologic regimes. Adaptations may be the result of phenotypic plasticity or genetic divergence, both of which play roles in speciation and evolution. This research utilizes a comparative field study and mesocosm experiment to determine (1) morphological differences between Campostoma anomalum inhabiting two distinct flow regimes and (2) whether phenotypic plasticity or genetic divergence is predominantly driving morphological variation in Campostoma anomalum across hydrologic gradients. We hypothesize Campostoma anomalum from hydrologically variable streams will exhibit smaller anterior body regions, larger caudal regions and less streamlined forms, while Campostoma anomalum from hydrologically stable streams will exhibit larger anterior body regions, smaller caudal regions and streamlined bodies, and variation in body morphology is predominately due to genetic divergence between populations. This study contributes to the understanding of how environmental factors drive natural selection, and may provide insight into the evolutionary consequences of disrupting natural hydrologic patterns, which are increasingly threatened by climate change and anthropogenic alterations.

DRIVERS OF ALGAL BIOMASS AND PRODUCTIVITY IN INTENSIVELY MANAGED AGRICULTURAL LAKES

Henderson, Kate; Murdock, Justin; Lizotte, Jr., Richard; Locke, Martin

102C
Tuesday, 19 May, 2015 16:30 - 16:45

Shallow, turbid oxbow lakes in northwest Mississippi are frequently manipulated for irrigation water sources, and hence experience depth fluctuations independent of seasonal rainfall. These lakes show large swings in dissolved oxygen (DO) and often turn hypoxic. Factors controlling primary productivity (and DO), such as light and temperature, typically correlate with lake depth. We collected phytoplankton and periphyton from deep and shallow sites seasonally in three oxbow lakes in northwest Mississippi. Additional phytoplankton and periphyton samples were incubated in different light and temperature regimes to explore the individual importance of these factors in regulating microbial metabolism. Both periphyton and phytoplankton biomass were more affected by season than water depth. Despite measurable algal biomass, periphyton respiration rates resulted in a net loss of DO. Under experimental light and temperature manipulations, phytoplankton biomass and productivity generally increased under high temperatures, but again experienced a strong seasonal effect. Periphyton biomass and productivity did not show strong responses to temperature. These data suggest water depth per se does not drive algal biomass and productivity; therefore, other factors may be more important for managers to consider.

TRACKING AQUATIC CONNECTIVITY AND HABITAT RESTORATION IMPROVEMENTS THROUGH FISH AND WILDLIFE MONITORING

Kroening, Kristina

101CD
Tuesday, 19 May, 2015 16:30 - 16:45

The Ozaukee County Planning and Parks Department has completed hundreds of aquatic connectivity and habitat restoration projects to improve ecological function in existing instream and riparian habitat in Ozaukee County portions of the Lake Michigan Basin. An important component of these projects is monitoring local fish and wildlife assemblages before and after restoration project implementation. Fish are monitored by electrofishing and larval fish trapping. Birds and other wildlife are monitored by conducting visual surveys (e.g. bird point count surveys, aquatic egg mass surveys, shoreline searches, basking turtle surveys), aquatic funnel trapping, frog calling surveys, cover object surveys and turtle trapping. The Department is using this information as baseline data to guide future restoration projects and evaluate project site species diversity, use of habitat before and after restoration, animal movement (mark/recapture), and evidence of reproduction. The Department involves the public through a well-developed volunteer program to strengthen the capacity of data collection while providing job training, education and outreach opportunities. This session will discuss the Department's monitoring efforts, results and application, and the success/structure of our volunteer program.

JUVENILE CHINOOK SALMON GROWTH AND DIET PATTERNS IN MAINSTEM HABITATS WITHIN THE SAN JOAQUIN RIVER RESTORATION PROGRAM

Blumenshine, Steve ; Spaulding, Taylor; Pearson, James; Portz, Don

101A
Tuesday, 19 May, 2015 16:30 - 16:45

The San Joaquin River is undergoing a large-scale restoration to reestablish the southern-most Chinook salmon run in North America. Restoration challenges include reduced discharge through drought and water diversions. Reduced discharges allow for testing a prevailing paradigm that juvenile Chinook salmon (JCS) require floodplain habitat. In this study we examine variation in JCS development and diets over time and site through C & N stable isotope signatures of prey items and juvenile liver and muscle tissue. Liver tissue reflects more recent (~7 days) C and N sources compared to muscle tissue which integrates a longer feeding history. Juvenile liver tissue was depleted in 13C and 15N relative to muscle. Liver 13C was highly variable among individuals but did not vary over time or with fish size. Liver 15N was less variable and decreased with fish size. Invertebrate delC and delN varied greatly among taxa, even within sample sites. Analysis of JCS otoliths for growth trajectories demonstrated that despite conventional theory, JCS growth rates in mainstem habitats were comparable to other populations and cohorts across central California rivers.

ARROWHEAD (SAGITTARIA CUNEATA) AS A BIOINDICATOR OF NITROGEN AND PHOSPHORUS FOR PRAIRIE STREAMS

Standen, Katherine; Chambers, Patricia; Culp, Joseph

102B
Tuesday, 19 May, 2015 16:45 - 17:00

Excess nitrogen (N) and phosphorus (P) from agricultural run-off is causing deteriorating ecosystem conditions of prairie streams in southern Manitoba, Canada. The emergent plant, arrowhead (Sagittaria) may be an ideal bioindicator of environmental stress because it is abundant, easily identifiable, and exhibits plastic responses to environmental factors (i.e., water depth, P concentration). To evaluate S. cuneata as a bioindicator, we conducted a 2x2 factorial-design experiment with high or low N and P added to nutrient-poor water (4 treatments) or nutrient-poor sediment (4 treatments), and an unamended control. Plants grown with added sediment nutrients produced, on average, 5.7X and 13.4X more tubers, 3.6X and 8.9X more leaves, and were 20 and 35% taller than plants with added water nutrients or controls, respectively. Leaves were also 2.1X and 2.9X larger for sediment-enriched plants than water-enriched and control plants, respectively, during peak growing season. Our results indicate that arrowhead exhibits plastic responses to sediment nutrients. Further research is continuing to develop and validate S. cuneata as an in-field method of identifying nutrient conditions in prairie streams.

NUTRIENT AND SEDIMENT RUNOFF FROM AGRICULTURAL WATERSHEDS: INSIGHTS FOR EFFECTIVE MANAGEMENT PRACTICES

Royer, Todd; Fulgoni, Jessica; Madison, Andrew; Jacobson, Sirese

102C
Tuesday, 19 May, 2015 16:45 - 17:00

From 2011 through 2014, ten streams in southeast Indiana were routinely sampled across all hydrologic conditions to examine the effectiveness of agricultural best management practices (BMPs) to reduce nutrient loading to streams. The watersheds were 60% or more cultivated crops. No effect of the practices could be detected in the nutrient data, however the data revealed characteristics about the runoff that could improve the design of effective agricultural BMPs. Turbidity ranged from <5 NTU to >1000 NTU across hydrologic extremes and there was a strong correlation between turbidity and total phosphorus. On average, nitrate-N was 97% of DIN across all flow conditions and maximum nitrate-N concentrations were >15 mg/L. Maximum nitrate concentrations occurred at intermediate discharge, whereas maximum phosphorus occurred during storm flows. As discharge increased, the molar ratio of DIN:SRP declined. The input of nitrate and phosphorus occurred under different hydrologic conditions and by different mechanisms, suggesting multiple BMPs are required to reduce loading of both nutrients. Controlling soil erosion could be effective at reducing phosphorus inputs, but the mobility of the nitrate ion presents challenges for BMP designs.

A HIERARCHICAL INVESTIGATION OF FACTORS INFLUENCING THE SPATIAL ECOLOGY OF JUVENILE CHINOOK SALMON IN A PACIFIC NORTHWEST RIVERSCAPE.

Denny, Lytle; Baxter, Colden

101A
Tuesday, 19 May, 2015 16:45 - 17:00

More spatially continuous approaches are needed to detect patterns across multiple scales and understand the relationships between river organisms and habitat heterogeneity in riverscapes. This is critical for imperiled fishes with complex life histories, such as Pacific salmon. Salmon restoration efforts focused on improving freshwater rearing habitats are rooted in empirical understanding of habitat relationships that may be incomplete owing to constraints of traditional techniques. We conducted a hierarchical and more spatially continuous investigation of factors that influence Chinook salmon abundance throughout the Yankee Fork Salmon River, Idaho, USA. We mapped habitat at multiple spatial scales and conducted single-pass electrofishing along this river. Highest fish abundance occurred in alluvial valley segments. Overall, abundance was spatially correlated at a reach-scale distance of ~90m, and reach types explained the most variation in abundance, with peaks occurring in those with braided side channels. Juvenile salmon preferred pools over riffles, but valley segment type mediated sub-categories of channel units selected (e.g., types of pools). Our findings inform conservation and restoration activities, particularly as they are applied at intermediate (e.g., reach) scales.

EMBEDDED METACOMMUNITIES IN THE CRAYFISH-BRANCHIOBDELLIDAN CLEANING SYMBIOSIS: A MULTI-SCALE FRAMEWORK FOR UNDERSTANDING SYMBIONT DIVERSITY

Brown, Bryan; Creed, Robert; Skelton, James

103DE
Tuesday, 19 May, 2015 16:45 - 17:00

Symbiosis is pervasive in nature, and only recently have we begun to understand the degree to which symbiosis influences ecological processes. However, understanding symbiont biodiversity at multiple spatial scales has proven challenging and the study of symbiosis has not incorporated many recent advances of general ecological theory. Metacommunity ecology provides the basic framework for understanding diversity at multiple scales but has been applied to symbiosis in only rudimentary ways. We propose an Embedded Metacommunity Framework that focuses on 3 key levels of organization: the symbiont inframcommunity in which symbionts interact on host “patches”, the symbiont metacommunity in which hosts are patches and dispersal among hosts drives biodiversity patterns, and the host metacommunity in which patches are locales on landscapes, and multiple host species interact across these localities. We demonstrate the utility of this framework using the cleaning symbiosis between crayfish and a diverse group of ectosymbiotic worms(branchiobdellidans). We demonstrate that 1) dynamics at the Symbiont Metacommunity scale affect assembly of the Symbiont Infracommunity; 2) invasion of non-native hosts at the Host Metacommunity scale drastically affects composition of the Symbiont Metacommunity.

CONSERVATION OF AQUATIC BIODIVERSITY IN A WORLD WITH LESS WATER: A MOLECULAR ECOLOGIST'S PERSPECTIVE

Hughes, Jane

Ballroom ABC
Wednesday, 20 May, 2015 09:15 - 10:00

As the world's population continues to grow, human water needs are growing accordingly, thus reducing the water available for sustaining our freshwater biodiversity. This is likely to be further exacerbated in areas where rainfall will decrease as a result of global climate change. Molecular ecologists have contributed substantially in recent years to our understanding of first, the levels and patterns of current biodiversity and second to understanding patterns of connectivity among populations of aquatic species and their significance for their conservation and management. Both are critical for prioritization of areas for protection and for designing rehabilitation programs. In this talk, I will attempt to synthesize our understandings to date. I will argue that a multi-disciplinary approach that incorporates new technological approaches in acquisition of molecular data is the best way forward for our aquatic biodiversity. Molecular ecologists can contribute by collaborating with other ecologists, especially in the fields of species distribution modeling and conservation planning. This approach will help to prioritize conservation actions for the best possible outcomes.

DISTRIBUTIONS AND FLUXES OF URANIUM IN THE LOWER REACHES OF THE YELLOW RIVER: ANTHROPOGENIC IMPACT (WATER-SEDIMENT REGULATION SCHEME)

Jiang, Xueyan; Liu, Qian; Sui, Juanjuan; Yu, Zhigang

102C
Wednesday, 20 May, 2015 10:30 - 10:45

As one of the most turbid rivers in the world, the Yellow River is also noted with its high dissolved uranium concentration, especially in the middle and lower reaches. Weathering products of the Loess Plateau exert influence on the dissolved U in the Yellow River. Water-Sediment Regulation Scheme (WSRS) is a procedure implemented annually to expel sediments deposited in Xiaolangdi and other large middle-reach reservoirs and to scour the lower reaches of the Yellow River, by controlling water and sediment discharges. This procedure may change the sources, forms, pathway of delivery and fluxes of uranium in the Yellow River. We investigated the different forms of uranium and other relevant parameters in the Yellow River of two representative sites of middle and lower reaches, Xianglangdi and Lijin, respectively. It is shown that the WSRS altered the ratios and sources of water and sediment, as well as the redox environment of the river water, therefore the forms of uranium delivered by the Yellow River water changed correspondingly. The seasonal fluxes of uranium were also changed by the WSRS.

EXPERIMENTAL FLOWS INCREASE RESILIENCE OF A REGULATED RIVER TO CATASTROPHIC DISTURBANCE

robinson, Chris; Ortlepp, Johannes; Scheurer, Thomas

102B
Wednesday, 20 May, 2015 10:30 - 10:45

Following adaptive management protocols, the flow-regulated Spol River has experienced multiple, annual experimental flows since 2000. The experimental flows were effective in enhancing the trout fishery as well as causing regime shifts in macroinvertebrates via changes in the habitat template. In late March 2013, the river was disturbed by a loss in flow followed by a major release of fine sediments from the reservoir; i.e. a catastrophic disturbance. The disturbance caused major reductions in fish and macroinvertebrate abundances, indicating low ecosystem resistance. Fish redd numbers were low the first year following the disturbance, although remaining fish were in good condition and recruitment expected to be high in subsequent years. Macroinvertebrate abundances and richness rebounded quickly, reaching predisturbance levels within months. When compared to flow effects from the early floods (year 2000/01), these data suggest that resilience of the river ecosystem to catastrophic disturbance was enhanced. These results highlight the importance of long-term monitoring in assessing the response patterns of regulated rivers to experimental flow release programs.

TRENDS IN STREAM BIODIVERSITY RESEARCH SINCE THE RIVER CONTINUUM CONCEPT

Tornwall, Brett; Skelton, James; Sokol, Eric; Brown, Bryan

103DE
Wednesday, 20 May, 2015 10:30 - 10:45

Lotic environments contain a disproportionate amount of biodiversity given their relatively small proportion of the worldwide landscape. We conducted a systematic literature search directed towards understanding factors that influence biodiversity in lotic habitats, published in 31 major ecological and freshwater science journals from 1981 to 2014. Our goal was to characterize emergent themes in research successes and identify important areas in need of study. We show an overwhelming taxonomic bias favoring studies of macroinvertebrates and fish. While most studies assessed diversity at a local scale, there has been a recent push to investigate regional drivers of beta and gamma diversity. Several factors were consistently found to be important drivers of diversity including local habitat type, hydrologic variables, disturbance, and stream morphometry. Others such as nutrients and chemical variables showed mixed support. Species interactions, dispersal, and evolutionary processes were rarely considered but show promise as fruitful areas for future study. We suggest that researchers should give increased attention to diversity drivers at different scales as well as take advantage of new molecular techniques to address questions regarding organismal diversity in streams.

MICROPLASTIC IN URBAN STREAMS: SOURCE, ABUNDANCE, AND SELECTION OF UNIQUE BACTERIAL ASSEMBLAGES

McCormick, Amanda; Hoellein, Timothy; Hittie, Joshua; London, Maxwell; Kelly, John

101B
Wednesday, 20 May, 2015 10:30 - 10:45

Microplastic particles (< 5mm) in oceans are an emerging ecological concern. Little is known about riverine microplastic, but plastic fibers (i.e., synthetic fabrics) and pellets (i.e., abrasives in personal care products) are abundant in wastewater treatment plant (WWTP) effluent which enters rivers. Our preliminary research showed microplastic, collected downstream of a WWTP, is more abundant than many marine sites and has higher occurrences of bacterial taxa associated with plastic decomposition and gastrointestinal pathogens than natural surfaces (e.g., seston and water column). In summer 2014, we collected surface water and sediment upstream and downstream of 10 WWTPs in Illinois, USA to quantify microplastic concentrations, determine if WWTPs are a point source, and compare bacterial communities on microplastic and natural surfaces. Microplastic concentration was significantly higher downstream of WWTPs than upstream, although concentrations varied among sites. Ongoing analysis of 16S rRNA genes via next-generation sequencing will describe bacterial communities on microplastic and natural substrates. We also expect WWTP methods (e.g., filtration and disinfection techniques) will influence assemblages. Results will inform policies and engineering advances focused on the evolving field of microplastic pollution.

INFLUENCES OF RIPARIAN FOREST STAND DEVELOPMENT ON STREAM PERIPHYTON, INVERTEBRATE AND VERTEBRATE POPULATIONS IN CASCADE MOUNTAIN STREAMS, OR.

Kaylor, Matthew ; Warren, Dana

103AB
Wednesday, 20 May, 2015 10:30 - 10:45

Riparian forests can influence ecosystem processes and biota in adjacent streams via controls on light availability, allochthonous organic matter input and large wood recruitment. Riparian forests are dynamic though. Their influence on light, organic matter or wood changes through time as a result of stand succession, disturbance events, and anthropogenic actions. In this study, we determine how approximately 40 years of riparian forest stand development has influenced vertebrate populations across five Pacific Northwest headwater streams. We also explore more broadly the relationships between forest structure, the stage of stand development (old growth vs. mid-seral), stream habitat, periphyton stocks, and stream vertebrate populations in 9 streams with paired old-growth/second-growth study reaches. In both the stand development study and the forest comparison study we found that canopy cover and light were closely associated with differences in periphyton accrual, fish biomass, and overall stream predator biomass over time and across streams. Canopy openness was significantly correlated with total vertebrate biomass ($p = 0.002$). In contrast (and somewhat surprisingly) neither large wood nor total pool area were significant predictors of trout and vertebrate biomass.

INTRODUCTION: TRANSITIONS IN UNDERSTANDING DIDYMOSPHENIA GEMINATA

Kunza, Lisa; Gillis, Carole-Anne

101A
Wednesday, 20 May, 2015 10:30 - 10:45

The widespread, yet elusive, diatom Didymosphenia geminata has captured the attention of scientists, managers, and policy makers alike. The increasing incidence of nuisance levels of benthic mats of D. geminata globally continues to drive efforts to better understand the basic biology and ecology of this species. Despite these efforts, environmental triggers to mat development as well as the impact to ecosystem processes and seasonal dynamics remain unclear. Recent and ongoing research examines phosphorus availability as a contributor to mat development and stalk length. Yet, the influence of other nutrients and whether the biogeochemical cycles are altered in the presence of D. geminata continues to be enigmatic. As the number of ecosystems containing D. geminata mats have increased over the last decade, it is imperative that the transition in understanding from the research of the past few decades, pushes us forward to a better understanding of the influence D. geminata may have on food web dynamics, ecosystem processes, and nutrient cycling in these oligotrophic lotic ecosystems.

MODELING THE RESPONSE OF CLIMATE-SENSITIVE, AQUATIC INSECT TRAITS TO MULTIPLE ENVIRONMENTAL FACTORS IN THE WESTERN UNITED STATES USING A BAYESIAN PATH MODEL

Pyne, Matthew; Poff, LeRoy

103C
Wednesday, 20 May, 2015 10:30 - 10:45

Two aquatic insect trait groups, cold stenotherms (taxa found only in cold water) and erosional obligates (taxa found only in fast flowing water habitat), have been used to assess the effect of climate change on stream macroinvertebrate communities, but most studies have not assessed regional variation in trait responses to current climate conditions and the contribution of non-climatic variables (e.g., habitat, geomorphology) on climate-sensitive trait distributions. We developed a Bayesian path model for 251 sites in the western United States to determine how cold stenotherm and erosional obligate distributions are influenced by climatic and non-climatic variables in eight climatic ecoregions. The models accounted for 40-85% of variation in cold stenotherm distributions in most ecoregions, but only accounted for 10-20% of the variation in erosional obligate distributions. Temperature and runoff drove distributions of cold stenotherms in the three temperate ecoregions while other non-climatic variables drove cold stenotherm distributions in some warmer ecoregions. Our results indicate that cold stenotherms may be at their thermal limits in warmer ecoregions and are selecting non-climatic stream conditions that mitigate the effect of high temperatures.

EVALUATING THREATS TO RAMSAR WETLANDS: LOCAL REPORTING VERSUS GLOBAL MAPPING

Fluet-Chouinard, Etienne; McIntyre, Dr. Peter

101CD
Wednesday, 20 May, 2015 10:30 - 10:45

Wetlands are among the most threatened ecosystems of the planet. Conservation of these habitats is undertaken globally through designation of Ramsar Wetlands of International Importance, though many of these sites remain threatened by human activity. Global patterns of threat to freshwater ecosystems were mapped from 23 distinct threats by Vörösmarty et al. (2010). Despite the maps' uncertainty, the data has not yet been leveraged to inform monitoring in Ramsar Sites. We compared for 12 of the 23 globally mapped threats against locally reported threats in the Ramsar Sites distributed around the world. The agreement between the mapped continuous indices and binary Ramsar reporting is evaluated separately for different combinations of continents and threat drivers. The mutual validation provided by the comparison highlights threats and continents where Ramsar reporting appears less consistent as well as identify mapped threats having weaker agreement with reporting. Overall, the comparison shows remarkable agreement given the scale mismatch between the two sources. The comparison also highlights threats (e.g. pesticide, sediment loading) and continents (e.g. Europe, Neotropics) where agreement is substantially lower than others.

MACROINVERTEBRATE RESPONSES TO CLIMATIC EXTREMES FOLLOWING A LEGACY OF STREAM HYDROLOGIC ALTERATION

Baumann, Karen; Scholl, Eric; Rantala, Heidi; Whiles, Matt

102DE
Wednesday, 20 May, 2015 10:30 - 10:45

With stream restorations increasingly common, ecological data to guide these efforts are in demand. The lower Cache River (LCR) in southern Illinois suffers from reduced flow, hypoxia, and sedimentation associated with an upstream diversion ditch. Resource managers are considering a partial reconnection to its headwaters, the upper Cache River (UCR), to restore flow. We examined macroinvertebrate communities in the UCR and LCR for four summers with conditions ranging from record drought to flooding to gain insight on responses to flow variability and inform restoration and management actions. Community composition in both reaches differed significantly among years ($p=0.0001$). Mean body size was significantly higher in the UCR ($p=0.002$), and highest overall in 2011, a flood year ($p=0.001$). Body size of chironomids, which dominate the LCR assemblage, was positively correlated with monthly discharge in June of all years ($p=0.008$). Spatial variability of chironomids (calculated as biomass coefficient of variation, CV) was negatively correlated with mean discharge ($p=0.04$). Responses to hydrologic variation indicate restored flow in the LCR could affect food quality (invertebrate body size) and patchiness (CV) available to higher trophic levels.

MEASURING SPATIAL VARIATION IN ECOSYSTEM PROPERTIES USING A COMMON CONSUMER APPROACH

Larson, James; Richardson, William; Evans, Mary Anne; Schaeffer, Jeff; Wynne, Timothy; Bartsch, Michelle; Bartsch, Lynn; Nelson, JC; Vallazza, Jon

101CD
Wednesday, 20 May, 2015 10:45 - 11:00

Direct measurements of ecosystem properties across large spatio-temporal gradients are often difficult. Here we explored the use of a common consumer to provide an index of key ecosystem properties. In a common consumer approach, individuals of a single species are raised under uniform conditions until placed across natural gradients of interest. The responses of that common consumer are measured to provide an index of environmental conditions. We placed hatchery-raised freshwater mussels (Lampsilis siliquoidea) across gradients in habitat and cyanobacterial abundance in the Lake Erie. After three months, mussels were retrieved and spatial variation in growth and the fatty acid (FA) content were measured. We interpreted these measurements as indices of secondary production and food quality, respectively. These metrics suggest that the Maumee rivermouth promotes high secondary production and provides more high-quality FA than open-lake sites. Unexpectedly, sites with high cyanobacterial abundance also had more high-quality FAs. While the common consumer approach allows for more spatial and temporal resolution in measurements than would otherwise be possible, care must be taken in interpreting results.

AQUATIC POLLUTION INCREASES USE OF TERRESTRIAL PREY SUBSIDIES BY STREAM FISH

Kraus, Johanna; Pomeranz, Justin; Todd, Andrew; Walters, David; Wanty, Richard; Schmidt, Travis

103AB
Wednesday, 20 May, 2015 10:45 - 11:00

Freshwater and terrestrial food webs are spatially linked through cross-ecosystem movements of energy and nutrients, which can augment consumer abundance and alter distribution. Reliance of consumers on cross-ecosystem subsidies depends in part on in situ resource availability, which can be reduced by anthropogenic and natural stressors. We tested the research question that as trace-metal pollution in streams increased, and aquatic prey availability decreased, stream fish (mainly Salmo trutta and Salvelinus fontinalis) would increase consumption of terrestrial insect subsidies in 16 sub-alpine headwater streams in the Colorado Mineral Belt, USA. Salmonids, the dominant fishes in these systems, increased their reliance on terrestrial insect prey (up to 50% by dry mass) as stream metals increased and aquatic prey availability decreased. Salmonid densities were unrelated to metal concentrations in fish-containing streams. Stream fish have the potential to become more dependent on terrestrial prey as aquatic stressors that limit in situ food production increase, suggesting a link between preserving aquatic-terrestrial linkages and fish populations in stressed watersheds. Specifically, intact aquatic-terrestrial linkages are likely to be important for maintaining salmonid production in moderately metal-impacted streams.

DIDYMO: IT'S ALL ABOUT THE STALKS

Gretz, Michael

101A
Wednesday, 20 May, 2015 10:45 - 11:00

If Didymosphenia geminata did not exhibit extraordinary extracellular polymeric substance (EPS) synthesis, it would not have attracted world-wide attention. Prodigious stalk production by D. geminata sets it apart from other diatoms and defines “bloom”, “nuisance” for this species. When considering diatoms, one usually conjures up images of smooth, clean, beautifully patterned silica frustules. In nature the glass “shoebox” is covered with slimes and a variety of EPSs that mediate interactions with the outside world. Diatom EPSs can self-assemble into specialized structures including tubes, apical pads, adhering films, fibrils, motility polymers and stalks. These provide for protection, adhesion, cohesion, motility, buoyancy, signaling, etc. D. geminata is valuable as a model system for study of EPS extrusion and self-assembly. Detailed examination of the chemistry, ultrastructure, molecular biology and physiology of stalk production allows for explanation of the dramatic nature of the recent proliferation of Didymo mats world-wide.

CONTRASTING RESPONSES OF BLACKFLY SPECIES (DIPTERA: SIMULIIDAE) TO EXPERIMENTAL STREAM WARMING

Nelson, Daniel; Benstead, Jonathan P. ; Huryn, Alexander D; Cross, Wyatt; Hood, James; Johnson, Philip; Junker, James; Gislason, Gisli; Olafsson, Jon

102DE
Wednesday, 20 May, 2015 10:45 - 11:00

Mean global surface temperature has risen 0.89°C over the past century and may increase by an additional 3-5°C by 2100. How freshwater communities will respond is an important question, yet information allowing accurate predictions is lacking. We experimentally warmed a stream in Iceland by approximately 3.5°C using a geothermal heat exchanger, and examined the abundance, biomass, and production of two congeneric blackfly species in the warmed stream and a nearby reference stream for 1 year prior to warming and 2 years during warming. Warming had a positive effect on the abundance, biomass, and production of Simulium vittatum in the experimental stream relative to the reference stream, but had a negative effect on the abundance, biomass, and production of S. vernum. The contrasting responses of these two species likely resulted from fundamental differences in their thermal preferences and whether these species existed below or above their thermal optima before warming. Our results indicate that species-specific thermal tolerances will be important in predicting population- and community-level responses to climate change, and that even closely related species cannot be assumed to respond similarly.

LEAF LITTER SPECIES AFFECTS THE ACTIVE AQUATIC MICROBIAL COMMUNITY

Schuettenberg, Alexa

103DE
Wednesday, 20 May, 2015 10:45 - 11:00

Microbial colonization of leaf litter in headwater streams is known to enhance litter quality for consumers and facilitate nutrient transfer to higher trophic levels; however, little is known about the response of the active microbial community to different litter species. We used stable isotope probing (18O labeled water) to examine how the active aquatic microbial community responded to five litter species with a range of decomposition rates. We explored two hypotheses: (1) the active aquatic microbial community would differ on the five litter species, and (2) the active microbial community would shift through decomposition time. We expected the active component of the microbial community to be relatively more bacterial dominated for fast-decomposing litter species and more fungal dominated for slow-decomposing litter species. We also expected the active community to shift from bacterial dominated to fungal dominated as decomposition progressed. Our study goes beyond traditional litter decomposition studies that document what microbes are associated with various litter types through time by measuring growth rates of microbial species during decomposition.

MICROPLASTIC PARTICLES ARE A NOVEL AND MOBILE HABITAT FOR MICROORGANISMS IN FRESHWATER ECOSYSTEMS

Kelly, John; Hoellein, Timothy; Mason, Sherri; McCormick, Amanda; London, Maxwell

101B
Wednesday, 20 May, 2015 10:45 - 11:00

Microplastic particles (<5 mm) are an environmental contaminant of emerging concern, as recent studies have shown high microplastic concentrations in marine habitats worldwide. Sources of microplastic include fragmentation of larger plastic materials, industrial manufacturing pellets, personal care products, domestic cleansers, and synthetic textiles. Our work has documented similar concentrations of microplastic in the Great Lakes, and higher concentrations in an urban river. We observed dense bacterial colonization of microplastic in these freshwater habitats, and analyzed this colonization in laboratory incubations of microplastic from commercial products. In all cases, next-generation sequencing analysis revealed that microplastic-attached bacterial communities were distinct in taxonomic composition from communities in associated natural habitats, e.g. water column, seston and benthos. For example, microplastic collected in an urban river downstream of a wastewater treatment plant had significantly higher abundance of bacterial species associated with human gastrointestinal infections. We also demonstrated that microplastic can be transported long distances in a river (> 10 km). Therefore, microplastic may represent a novel microbial habitat that can transport a distinct suite of bacteria over long distances within freshwater ecosystems.

PERSISTENCE AND STABILITY OF PÁRAMO MACROINVERTEBRATE COMMUNITIES IN STREAMS WITH CONTRASTING NATURAL DISTURBANCE REGIMES

Finn, Debra; Hampel, Henrietta; Encalada, Andrea

102B
Wednesday, 20 May, 2015 10:45 - 11:00

Páramo streams are headwaters occupying tropical high altitudes. Conversely to high-altitude temperate streams, páramo streams experience minimal seasonality. Maximum variation in temperature/flow typically occurs on diel rather than annual scales. But similarly in tropical and temperate zones, high-altitude streams are strongly heterogeneous, ranging from groundwater-dominated (stable) to runoff-dominated (unstable environment). We measured conductivity, suspended solids, streambed stability, and temperature/flow regimes of a number of streams on two glaciated volcanoes of the Ecuadorian Andes. We used these data to identify six focal pairs of groundwater/runoff-dominated streams each occupying the same watershed and altitudinal band (~4000 m asl) and are currently monitoring assemblage persistence (taxon presence/absence) and stability (compositional similarity) with monthly macroinvertebrate sampling. Preliminary results suggest that groundwater-dominated streams maintain greater abundance, biomass, diversity, and assemblage stability and persistence than do environmentally unstable runoff-dominated streams. Runoff-dominated assemblages tend to comprise a subset of groundwater-dominated assemblages, although some taxa are found predominantly in runoff streams. Our results will inform biomonitoring for effects of anthropogenic disturbance and will provide insight into the effects of shrinking glaciers, which directly influence runoff-dominated páramo streams.

EVALUATION OF AGENCY AND VOLUNTEER STREAM MONITORING PROTOCOLS USING MACROINVERTEBRATE ASSEMBLAGES

Petry, David; Colombo, Robert; Pederson, Charles; Laursen, Jeffrey

103C
Wednesday, 20 May, 2015 10:45 - 11:00

Professional stream assessments can be both time and cost intensive. Many states have developed citizen science programs in efforts to provide reliable data to supplement agency assessments. To test how two of these protocols and their conclusions compare, we sampled 16 sites in seven streams within east central Illinois using two different techniques: Illinois RiverWatch and Illinois Environmental Protection Agency (IEPA). The two techniques resulted in different assemblage structures (PERMANOVA; $p=0.0010$). Neither physical habitat score, as assessed using Qualitative Habitat Evaluation Index (QHEI), nor RiverWatch-level Macroinvertebrate Biotic Index (MBI) scores were correlated with most indices utilized by IEPA to determine stream health. These differences are likely due to different microhabitats sampled while following the two protocols. In the majority of qualitative disagreements, Illinois RiverWatch overestimated stream quality compared to IEPA. Additionally, seasonal variation was evident between spring and fall Illinois RiverWatch samples with differing assemblage structure (PERMANOVA; $p=0.0020$), and generally lower MBI scores in fall representing higher quality. We are currently examining the effects of taxonomic resolution as well as evaluating other metrics to increase qualitative agreement between techniques.

ASSESSING THE EFFECTS OF RIVERBANK INDUCEMENT ON GROUNDWATER QUALITY ON A SHALLOW AQUIFER IN SOUTHEASTERN WISCONSIN

Fields-Sommers, Laura; Grundl, Timothy

102C
Wednesday, 20 May, 2015 10:45 - 11:00

River bank inducement, the implementation of shallow wells near river systems to induce flow to the aquifer, is being used to augment groundwater supplies in portions of southeastern Wisconsin. However, river bank inducement wells (RBI) are vulnerable to contamination due to their close interaction with the surface water. The vulnerability increases when induced surface waters contain municipally treated waste water. An ideally located, existing monitoring network in Waukesha County, Wisconsin with two RBI wells and a background well are being utilized as the field site for this study. This study intends to determine the recharge mechanisms of the RBI well field, discriminate the source(s) of salt influx seen in the well field, and continue overall geochemistry tracking in order to compile a long-term data base with which to compare future changes. Stable isotope analysis of ?18O and ?2H ratios will be used to define the dynamics of the river and riverine influx into the well field. Major ion analysis of the well field will furnish a continuation of characteristics of the well field and the breakthrough curve associated with pumping.

SPATIAL AND TEMPORAL RESPONSE PATTERNS OF ECOSYSTEM METABOLISM FOLLOWING A CHANNEL ALTERING FLOW EVENT IN PRAIRIE STREAMS

Ruffing, Claire; Dodds, Walter; Veach, Allison; Rueegg, Janine; Trentman, Matt

102B
Wednesday, 20 May, 2015 11:00 - 11:15

Ecosystem processes in intermittent streams systems can be radically altered by channel-disturbing flow events following periods of drought. In order to understand the resiliency of ecosystem function to disturbance events, such as flooding, we measured rates of gross primary production (GPP), ecosystem respiration (ER) and net ecosystem production (NEP) using continuously logged dissolved O2 and temperature for thirty days following a storm event. Streams are characterized by increasing canopy cover from the headwaters downstream related to burning regimes. The stream with the least dense canopy cover experienced an increase in GPP and ER and remained heterotrophic over the 30 days. Conversely, the stream with the most dense canopy cover was characterized by a gradual decrease in GPP, a decrease in ER, and intermittent periods of autotrophy following the event. However, rates observed for each day at both sites were lower than previous estimates of GPP and ER for those sites at similar times of the year. Despite the immediate influence of flooding on GPP and ER, the effect of the preceding drought conditions may influence limits to recovery.

URBAN MICROBIAL ECOLOGY OF THE MILWAUKEE ESTUARY AND HARBOR

Fisher, Jenny; Newton, Ryan; Dila, Deb; McLellan, Sandra

101B
Wednesday, 20 May, 2015 11:00 - 11:15

Freshwater estuaries throughout the Great Lakes region receive stormwater runoff from heavily urbanized population centers. While human and animal feces contained in this runoff are often the focus of source tracking investigations, non-fecal bacterial loads from soil, aerosols, and urban infrastructure are also transported to the estuary and lake. We quantified and characterized this non-fecal urban bacterial component using bacterial 16S rRNA sequences from sewage, stormwater, and aquatic environments surrounding Milwaukee, WI. Microbial communities from each of these environments had a distinctive character. Components of the microbial community that affiliated most strongly with stormwater can be considered an "urban microbial signature," and we can track these organisms to the harbor/estuary and lake. Estuary samples collected from the junction of three rivers and outer edge of the harbor varied in their composition, but tended to have higher urban signatures that correlated to increased rainfall. Over 50 million people live in urban population centers along within the Great Lakes region; as urbanization continues, increased loading of urban bacteria may have long term impacts on nearshore ecosystems.

EFFECTS OF SUBSTRATE AVAILABILITY AND INCREASED SALINITY ON METHANOGENESIS IN PONDS OF THE COPPER RIVER DELTA, ALASKA

Vizza, Carmella; West, William; Jones, Stuart; Hart, Julia; Lamberti, Gary

101CD
Wednesday, 20 May, 2015 11:00 - 11:15

Freshwater wetlands contribute approximately 25% of global CH4 emissions; however, predicting their response to climate change is challenging. Longer growing seasons could increase the availability of labile substrate, whereas sea level rise may potentially reduce methanogenesis in coastal habitats. For ponds of the Copper River Delta, Alaska (CRD), we conducted laboratory sediment incubations to measure the response in methanogenesis to different macrophyte detritus and to seawater intrusion. Adding detritus tripled methanogenesis in some treatments, although the magnitude varied by species. Methanogenesis in freshwater ponds was double that of intertidal marsh, but adding saline water (~12 ppt) to pond sediment did not alter CH4 production rates. Our results suggest that overlying water chemistry, such as the increased sulfate in seawater, does not immediately influence methanogenesis; rather, sediment characteristics, including organic content or microbial communities, may be more important. Furthermore, longer growing seasons and subsequently greater substrate availability will likely increase methanogenesis in CRD ponds, but the magnitude of these effects will depend on macrophyte species present. Future research should consider the effects of substrate quantity and quality on methanogenesis.

CAN CHANGES IN THE VALVE MORPHOLOGY OF DIDYMOSPHENIA GEMINATA AMONG BLOOM POPULATIONS HELP EXPLAIN RECENT INVASIONS?

Pillsbury, Robert; Glas, Brenna

101A
Wednesday, 20 May, 2015 11:00 - 11:15

In the last two decades, the diatom Didymosphenia geminata has produced nuisance blooms in many parts of the world that had previously been free of this problem. Recent blooms could be caused either by the introduction of a particularly aggressive strain spreading into new areas or environmental changes that would cause locally present but cryptic populations to bloom. Using landmark-based shape analysis, we examine patterns in valve morphology among and within populations of D. geminata in two main areas: across North American, and New Zealand. The patterns of shape variation in North America were low within a population but often distinct among populations suggesting the environmental change model. While relatively low variability in valve shape within and among New Zealand populations is consistent with the Aggressive Colonization model which supports the prevailing notion that D. geminata is non-native in that country.

SPATIAL HETEROGENEITY IN RIVER TEMPERATURE ASYNCHRONIZES AQUATIC INSECT EMERGENCE, AND PROLONGS THE FOOD SUPPLY TO PREDATORS

Uno, Hiromi; Power, Mary

103AB
Wednesday, 20 May, 2015 11:00 - 11:15

Many natural rivers encompass microhabitats with considerable spatial heterogeneity in patch- or reach-scale water temperatures, especially during summer low flow. This temperature variation may increase the trophic efficiency of cross-habitat exchanges, so subsidies support more predators. Ephemerella maculata is a mayfly that emerges from sunlit mainstem rivers, flies into dark, unproductive tributaries, oviposits, and dies. Their mass migration subsidizes tributary predators that would otherwise be food-limited. Experimentally reared E.maculata nymphs emerged earlier at warmer temperatures. Mayflies in nature emerged earlier from warmer sunlit mainstem habitats and later from cooler, shaded or upstream reaches. While the emergence from each thermally distinct habitat lasts only two weeks, the overall, asynchronized E.maculata emergence lasted four weeks, corresponding to the observed 4-week adult flight period in tributaries. Preliminary 34S isotope analyses indicate that adults that arrived earlier in tributaries originated from warmer downstream mainstem reaches, and later arrivals came from cooler upstream habitats. The spatial thermal heterogeneity that prolongs flight periods of E.maculata also increases the duration, hence the trophic efficiency, of the subsidy they deliver to tributary predators.

EFFECTS OF TAXONOMIC HARMONIZATION AND FIXED-COUNT SUBSAMPLING ON COMPARABILITY OF INVERTEBRATE DATA FROM MULTIPLE SOURCES

Cuffney, Thomas; Kennen, Jonathan

103C
Wednesday, 20 May, 2015 11:00 - 11:15

Regional investigations of invertebrate responses to perturbation often involve combining data from multiple sources that use different methods to collect and process samples. We evaluated the effects of harmonizing taxonomy and subsample size on the comparability of data from nine sources differing in levels of identification (species, genus, family) and subsample sizes (100, 200, 300, and > 300 fixed counts). Two approaches to taxonomic harmonization were compared: (1) rolling up taxa to genus and (2) rolling up taxa to the lowest taxonomic level across sources. Metrics and Bray-Curtis similarities were calculated and compared on the basis of 25, 100-count subsamples. Harmonizing taxonomy and standardizing to a 100 fixed-count subsample significantly increased comparability among samples with taxonomic harmonization having much larger effects on comparability among samples than did standardizing to a common subsample size. Rolling up taxa to genus was not as effective as the more labor intensive taxon-by-taxon comparison of the lowest level used across sources. Data from different sources can be processed to increase comparability, but great care needs to be exercised in harmonizing the taxonomy across data sources.

INFLUENCE OF RESOURCE PULSES ON ECOLOGICAL NETWORKS: INSECTS, SALMON AND THEIR MICROBIOMES

Pechal, Jennifer L.; Benbow, M. Eric

103DE
Wednesday, 20 May, 2015 11:00 - 11:15

Resource subsidies are recognized to cross ecosystem boundaries and influence the structure of ecological networks, especially in systems where animals migrate to reproduce and then die – creating ephemeral carrion resources subsidies. This is particularly true in settings with relatively predictable nutrient pulses, such as salmon-bearing streams of Alaska. The objective of this study was to assess the internal microbiome of aquatic insects (Ephemeroptera and Plecoptera); carrion flies (Diptera: Calliphoridae), which have been shown to move carcass nutrients into the riparian forest; and salmon carcasses. Microbial communities were collected from five streams (salmon bearing and non-salmon bearing) and characterized using Illumina MiSeq. There was an increase in unique operational taxonomic units (OTUs) detected in mayfly larvae collected from salmon bearing streams (1,505) compared to non-salmon streams (1,317). Additionally, carrion fly adults had an increase in unique OTUs (5,400) when compared to carrion fly larvae (1,515) developing on salmon carcasses, which suggests important salmon carcass effects on the insect microbiome. These data are foundational in describing resource subsidy-driven network responses to resource pulses with potential bottom-up effects on food web structure.

AQUATIC INSECT COMMUNITY STRUCTURE AND SECONDARY PRODUCTION IN SOUTHCENTRAL ALASKA STREAMS WITH CONTRASTING THERMAL AND HYDROLOGIC REGIMES

Hertel, Samantha; Berg, Martin B.

102DE
Wednesday, 20 May, 2015 11:00 - 11:15

Streams along the Copper River Delta, southcentral Alaska, exhibit contrasting thermal and hydrologic variability associated with being primarily groundwater-fed (GWF) or surface water-fed (SWF). Groundwater-fed streams are predictable both thermally and hydrologically year round, whereas SWF streams are unpredictable and exhibit more variable thermal and hydrologic regimes. These differences may strongly influence aquatic insect community structure and secondary production. Four streams, two GWF and two SWF, were sampled twice monthly from late April 2013 through August 2013 and once seasonally in fall (September) and winter (November). Community structure differed markedly in both stream types. Diversity was significantly higher in SWF than in GWF streams. Principal components analysis of community structure revealed two distinct groups corresponding to GWF and SWF streams. Secondary production was higher in GWF than in SWF streams with Baetis sp. (Ephemeroptera) having the highest rates in both sets of streams. Results from this study have strong implications for aquatic insect communities in GWF and SWF streams because of differing susceptibilities of these systems to the potential effects of climate change.

ANCIENT OUTGASSING AND MODERN FERMENTATION: DUAL SOURCES FOR A METHANE-DRIVEN HYPORHEIC FOOD WEB

DelVecchia, Amanda G; Stanford, Jack A

102C
Wednesday, 20 May, 2015 11:00 - 11:15

Thirty years of research on the Nyack floodplain (Middle Fork of the Flathead River, MT) have emphasized speciose and abundant hyporheic macroinvertebrates despite carbon limitation and low rates of productivity in the alluvial aquifer. We investigated the source and role of methane in the food web by radiocarbon dating and 13C and 2H isotopic measurement of hyporheic stonefly biomass, particulate organic matter, and methane. A two end-member mixing model indicated that most stoneflies collected were 70-100% dependent on methane as a carbon source as opposed to particulate organic matter, suggesting that stoneflies might be directly dependent on chemotrophy in the aquifer. Methane concentrations were unusually high, ranging up to 170 µmol/L, and heterogenous in source. While at most sites acetoclastic methanogenesis was the dominant methane source, one site yielded dissolved methane aged at 6900 ± 140 years and stonefly biomass carbon aged at 1300 ± 80 years. We therefore infer an extremely efficient hyporheic food web based on fermentation through the majority of the aquifer, but subsidized by an ancient methane source at specific sites.

EFFECTS OF AN AERATION SYSTEM ON VERTICAL DISTRIBUTION AND MIGRATION OF ZOOPLANKTON IN A RESERVOIR.

Nakano, Daisuke; Kobayashi, Takuya

101CD
Wednesday, 20 May, 2015 11:15 - 11:30

Aeration systems are often installed in lakes and reservoirs to conserve water quality and control phytoplankton bloom. They destroy the summer stratification by altering lake-mixing regime. The changes in flow regimes would affect vertical distribution and migration of zooplankton in lentic environment. In general, vertical flows are large at immediately near an aerator and gradually decrease with distance from the aerator. We investigated vertical distributions of zooplankton at two sites in a reservoir with aeration systems. One site (site A) was located at a nearby the aerator installed point. Another site (site B) was about 150 m away from the aerator. Automatic samplers collected zooplankton samples at eight depths of the site A and seven depths of the site B in four periods (3:00, 9:00, 15:00 and 21:00) of day to research the duel vertical migrations of zooplanktons. Simultaneously, it was measured 3-dimensional flows of the sites by the Acoustic Doppler Current Profiler (ADCP). We discuss the effects of flow regime alteration by aerator on vertical distribution and migration of zooplankton.

EXPERIMENTAL N AND P FERTILIZATION OF FIVE DETRITUS-BASED HEADWATER STREAMS REVEALS EFFECTS OF RESOURCE STOICHIOMETRY ON CONSUMER BIOMASS AND PRODUCTION

Demi, Lee; Benstead, Jonathan P. ; Rosemond, Amy D. ; Maerz, John C.; Gulis, Vlad

103DE
Wednesday, 20 May, 2015 11:15 - 11:30

Altered global N and P availability may influence food webs by causing shifts in the stoichiometric quality (C:N:P ratio) of basal carbon sources. Such shifts can lead to changes in individual growth rates of consumers, thereby altering population and community dynamics. We tested invertebrate responses to microbially modulated changes in detrital stoichiometry by continuously adding N and P at different dissolved N:P ratios (2:1, 8:1, 16:1, 32:1, 128:1) to five detritus-based headwater streams at the Coweeta Hydrologic Laboratory (North Carolina, USA) for two years. Primary consumer and shredder biomass was higher in all five streams during both years (year 1=12%-117%, year 2= 29%-190% among taxa?) of N and P enrichment compared to the year prior to enrichment. Production of Pycnopsyche and Tallaperla increased following enrichment in all five streams by averages of 150% and 1174%, respectively, and decreased with increasing leaf litter C:P ($p<0.05$), suggesting P limitation of these two common shredders. Release of primary consumers from nutrient limitation, driven by shifts in detrital stoichiometry, may affect community structure and alter material flows to higher trophic levels.

GEOGRAPHIC EXTENSION OF BENTHIC INVERTEBRATE RCA BIOASSESSMENTS: HOW FAR CAN WE GO?

Novodvorsky, Nicole; Bailey, John; Reynoldson, Trefor

103C
Wednesday, 20 May, 2015 11:15 - 11:30

Benthic invertebrate RCA bioassessments are generally developed using reference sites within a localized area such as a watershed or ecoregion. If such reference data can be used to assess test sites that lie outside their geographic scope, it would reduce the need to collect time-consuming and costly reference site data. In this study, we examined invertebrate and environmental data to assess concordance of benthic communities and develop predictive models using data from three areas in Canada: the Attawapiskat River watershed in northern Ontario, the Fraser River watershed in British Columbia, and the Yukon River watershed. RCA bioassessments were developed based on reference sites from the individual watersheds and on pooled data from the three. The effectiveness of assessments was evaluated using a common set of artificially impaired sites. The results of this study reveal that assessments using reference sites from other watersheds perform similarly to those using only local reference data, suggesting that reference sites sampled in one watershed could be "exported" for effective bioassessment in other adjacent or more distant watersheds.

WHERE DOES THE SULFATE COME FROM: LINKING ORGANIC SULFUR SPECIATION IN PEATLANDS TO SULFATE RELEASE FOLLOWING DROUGHT

Coleman Wasik, Jill; Toner, Brandy; Engstrom, Daniel; Drevnick, Paul

102C
Wednesday, 20 May, 2015 11:15 - 11:30

Boreal peatlands are often considered to be sinks for atmospherically deposited sulfate. However, episodic pulses of sulfate from these systems have been noted when peatlands are resaturated following drought. Because most of the sulfur in peatlands is bound to the solid phase, and the majority of that sulfur is found in organic forms it has been speculated that the sulfate released following drought represents organic sulfur that has been mineralized to inorganic sulfate. In this study peatland soil samples were collected during wet/saturated and dry/oxidized hydrologic conditions from a peatland in which atmospheric sulfate deposition had been experimentally manipulated. Organically bound sulfur comprised >95% of total sulfur in the soil. Sulfur speciation within the organic sulfur pool was determined at the micron scale in peat samples by X-ray fluorescence mapping and X-ray absorption near-edge spectroscopy. Total and inorganic sulfur concentrations did not vary with hydrologic condition. However, X-ray absorption analyses followed by principal components analysis indicated a shift in speciation among organically bound sulfur groups in wet/saturated soils compared to dry/oxidized soils across sites that had experienced varying sulfate inputs.

GROUNDWATER INFLUENCE ON WINTER INVERTEBRATE COMMUNITIES IN SOUTHEASTERN MINNESOTA STREAMS

Mazack, Jane; Vondracek, Bruce; Ferrington, Jr., Leonard

102DE
Wednesday, 20 May, 2015 11:15 - 11:30

Groundwater-fed streams, which remain ice-free in winter, provide ideal habitat for winter-active insects. Previous studies of these insects have focused on their thermal tolerance limits and emergence patterns; however, their relationships to groundwater input and the invertebrate community are not well-established. We documented invertebrate community composition and abundance in 36 groundwater-fed streams in southeastern Minnesota during the winters of 2010-2013. Hess samples were collected on three occasions at each site, with 12 sites sampled each winter. Dominant genera within the invertebrate communities included Baetis and Ephemerella (Ephemeroptera), Brachycentrus and Glossosoma (Trichoptera), Diamesa (Diptera: Chironomidae), and Gammarus (Amphipoda). Community composition patterns significantly varied among streams, with one or more of the dominant genera absent or nearly absent from each stream. Both invertebrate community composition and abundance were dynamic throughout the winter in each stream. Invertebrate abundance was significantly related to groundwater input, with average winter abundances ranging from 800 to nearly 10000 individuals per square meter of riffle habitat. Thus, we conclude that groundwater inputs within southeastern Minnesota's karst landscape significantly influence winter invertebrate dynamics in area trout streams.

DIDYMO IN PINE CREEK, PENNSYLVANIA: ENVIRONMENTAL FACTORS CONTROLLING DISTRIBUTION AND PLANS FOR FUTURE RESEARCH

Shank, Matthew

101A
Wednesday, 20 May, 2015 11:15 - 11:30

In 2013, Didymosphenia geminata (didymo) was first documented in Pine Creek, a highly recreated tributary to the Susquehanna River in north-central Pennsylvania, USA. Environmental DNA monitoring has since confirmed that didymo is confined to one tributary and from there downstream throughout Pine Creek. Preliminary data suggest that didymo coverage is highest during the late fall months in this free flowing system. Longitudinal observations indicate that dissolved phosphorus concentrations may limit the spatial distribution of didymo to cold, nutrient poor headwater reaches. Other stalked diatoms (Gomphoneis sp.) have been observed in adjacent tributaries with incrementally higher phosphorus concentrations. Upcoming research is planned that will examine the current and historic distribution of didymo throughout Pine Creek and surrounding watersheds in Pennsylvania. Habitat suitability of 17 Pennsylvania watersheds will be determined using a combination of continuous instream water chemistry, dissolved phosphorus, and stream morphology data. Additionally, the physiologically important fatty acid content of didymo vs. non-didymo biofilms will be examined. This research is intended to provide much needed technical understanding of didymo in the mid-Atlantic region, USA.

DETECTING AND LOCATING SOURCES OF SEWAGE CONTAMINATION IN SURFACE WATER USING OPTICAL PROPERTIES OF WATER

Christel, Samuel; Corsi, Steve; Lenaker, Peter; Baldwin, Austin; Pellerin, Brian; Bergamaschi, Brian; McLellan, Sandra; Stanley, Emily

101B
Wednesday, 20 May, 2015 11:15 - 11:30

Outdated and failing municipal separated stormwater (MS4s) and sanitary sewers are emerging as a major threat to water resources in the United States. In recent years, research has demonstrated that stormwater often harbors numerous contaminants such as human-specific pathogens, pharmaceuticals, surfactants, and fire retardants. The occurrence of sewage-derived contaminants in stormwater suggests that sanitary sewage is mixing with stormwater through illicit connections, cracks in sanitary lines, or other mechanisms that result in leakage of sewage into MS4s. Detecting sewage in stormwater is currently a cost and time prohibitive task for municipalities. Optical properties of water, that is, fluorescence and absorbance spectroscopy allows for rapid characterization of dissolved organic matter in stormwater. Optical properties of water can be decomposed in a variety of ways to develop statistical relationships that predict the occurrence of sewage in stormwater associated with human waste. These statistical relationships can be further leveraged to develop field-level optical sensors that municipalities could use in real-time to locate and identify potential sources of MS4 failures.

VARYING PREY SUBSIDY QUALITY AFFECTS THE GROWTH RATE OF SUBSIDIZED TERRESTRIAL CONSUMERS

Merkley, Steven

103AB
Wednesday, 20 May, 2015 11:15 - 11:30

The growth and development of subsidized consumers may be limited by prey nutrient quality. Significant interspecific variation of nutrient stoichiometry in prey species may create an imbalance in predator body stoichiometry. Due to this imbalance, predators may suffer losses of growth and development time, and/or differentially excrete or store excess carbon (C) or nutrients in order to maintain body stoichiometry. For this experiment, I tested how different diets of prey (Culex quinquefasciatus, Chironomus dilutus, and Drosophila melanogaster) of varying nutrient quality affected the growth and development of predatory terrestrial spiders (Tetragnatha sp.). Spiders fed on mosquitoes (Cx. quinquefasciatus) had significantly lower body nitrogen (N) and higher C-N ratio than spiders fed on midges (C. dilutus) or fruit flies (D. melanogaster). Although spiders fed on mosquito diet had lower growth rate during early instars, growth rate increased during later instars compared to spiders fed on other diets. Spiders fed mosquitoes had significantly lower δ 13C ‰ than mosquitoes they were fed on, while other treatments did not differ significantly in isotopic signature from their prey.

TAKING A BROADER PERSPECTIVE: CATCHMENT-LEVEL WILDFIRE VARIABILITY AND CLIMATE DRIVE RIPARIAN SPIDER RESPONSES IN YOSEMITE NATIONAL PARK, CA

Jackson, Breeanne K.; Sullivan, S. Mazeika P.

102B
Wednesday, 20 May, 2015 11:15 - 11:30

Whereas studies of wildfire effects on riparian ecosystems commonly account for variability at the reach scale, broader-scale factors including catchment wildfire and climate may be important to consider, especially in Mediterranean ecosystems characterized by frequent drought and high-severity wildfires. From 2012-2013, we investigated how precipitation and wildfire severity, frequency, and extent effect tetragnathid spider density, mercury (Hg) body loads, trophic position (TP), and reliance on aquatic energy (i.e., derived from benthic algae) at twelve paired reaches. In 2014, we resurveyed these variables at two control reaches and two reaches burned by the Rim Fire in 2013 in a BACIP (paired before-after, control-impact) design. With fire as a reach-scale categorical variable (high vs. low severity), differences in spider responses between pairs and after the Rim Fire were largely insignificant. However, model-selection results using quantitative predictors across both reach and catchment scales indicated that stream macroinvertebrate density, catchment-scale fire frequency, and precipitation were key drivers of spider density and TP. These results provide initial evidence that climate and catchment-scale wildfire variability are important to consider when describing aquatic-terrestrial linkages in Mediterranean ecosystems.

MACROINVERTEBRATE STRUCTURAL AND CONSUMPTION RESPONSES TO DIDYMOSPHENIA GEMINATA MATS IN THE UPPER TENNESSEE RIVER WATERSHED

Murdock, Justin; Knorp, Natalie; Hix, Lucas

101A
Wednesday, 20 May, 2015 11:30 - 11:45

Didymosphenia geminata (Didymo) mats can blanket stream substrata, changing habitat and food resource availability for benthic species. Given that eradication of Didymo from a stream is unlikely, it is important to critically assess mat impacts on ecosystem structure and function. We studied the relationships among benthic macroinvertebrates and Didymo in three Tennessee streams to assess changes in community composition and food resource use. Similar to previous studies, total invertebrate abundance consistently increased with increasing Didymo abundance, attaining a 6-fold increase in mats. Few correlations with specific groups were found. Emphemerella sp. was the most abundant EPT genera and its abundance decreased with increasing Didymo in two streams. However, Emphemerella were overall most abundant at the site with highest Didymo coverage. Despite little influence on composition, stable isotope analysis suggested that Didymo mats shifted invertebrate consumption away from rock biofilms to biofilms growing on macrophytes and leaves. Didymo cells were only a major food resource in one stream, and for only isopods, snails, and crayfish. Overall, Didymo mats had a stronger impact on macroinvertebrate resource use than on their composition.

CLIMATE WARMING AND AGRICULTURAL STRESSORS INTERACT TO DETERMINE STREAM MACROINVERTEBRATE COMMUNITY DYNAMICS

Piggott, Jeremy; Townsend, Colin; Matthaei, Christoph

102DE
Wednesday, 20 May, 2015 11:30 - 11:45

Global climate change is likely to modify the ecological consequences of currently acting stressors, but potentially important interactions between climate warming and land-use related stressors remain largely unknown. Agriculture affects streams and rivers worldwide, including via nutrient enrichment and increased fine sediment input. We manipulated nutrients (simulating runoff), deposited fine sediment (simulating erosion) (2 levels each) and water temperature (8 levels, 0-6°C above ambient) simultaneously in 128 streamside mesocosms to determine the individual and combined effects of the three stressors on macroinvertebrate community dynamics (community composition and body size structure of benthic, drift and insect emergence assemblages). Changes in benthic community composition showed a complex interplay among habitat quality (with or without sediment), resource availability (with or without nutrient enrichment) and the behavioural/physiological tendency to drift or emerge as temperature rose. Of particular importance is that community measures of stream health routinely used around the world (taxon richness, EPT richness and diversity) all showed complex three-way interactions, with either a consistently stronger temperature response or a reversal of its direction when one or both agricultural stressors were also in operation.

THE EFFECTS OF LONG-TERM DRAINAGE ON THE SAX ZIM BOG, NORTHEAST MINNESOTA

Deuschle, Deric; Urban, David

101CD
Wednesday, 20 May, 2015 11:30 - 11:45

In the 1920's, an extensive network of drainage ditches was constructed in a portion of the Sax-Zim Bog, in northeast Minnesota. While the plan to create productive farmland was unsuccessful, the ditches remain, and continue to function, although they are not maintained. Loss of hydrology through drainage has resulted in oxidation and humification of organic soils, which is a physical loss of carbon as the water table is depressed within the lateral effect of these ditches. This process has altered topography to create large subsidence areas, halted the process of paludification, and has shifted large portions of the soils from ombrotrophic to minerotrophic. This change in physical characteristics has resulted in alteration of the native plant communities as evidenced by Floristic Quality Analysis. watershed-level restoration of approximately 24,000 acres of the bog is proposed by physical removal of the ditch network through ditch checks and filling, which will restore groundwater based hydrology, halt oxidation of the dried soils, reinitiate the paludification process, and create an environment conducive to the historic plant communities, including Sphagnum bog and fen.

STREAM WATER QUALITY AND MACROINVERTEBRATES CONDITION IN AN URBANIZED WATERSHED OF THE LOWER MISSISSIPPI RIVER BASIN

Chen, Yushun; Shrestha, Sagar; Herzog, Kathryn

101B
Wednesday, 20 May, 2015 11:30 - 11:45

Little information is available on effects of urbanization on stream ecosystems in the Lower Mississippi River Basin. Base flow water samples were collected and analyzed monthly from four urban and four suburban streams from June 2011 to December 2013. Macroinvertebrates were assessed twice (October and March) each year during this period by a 500-µm mesh D-frame net. In the urban subwatersheds, dense residential housing, commercial buildings, and surface runoff from streets and highways were the primary stressors. In contrast, stressors in suburban subwatersheds included lawn/pasture and scattered residential housing. In urban streams, we generally found that water temperature, conductivity, dissolved oxygen, and pH were greater compared to suburban streams. Conversely, turbidity and major nutrient species were generally lower in urban streams compared to suburban streams. There were more taxa groups in the urban than suburban streams. EPT (Ephemeroptera, Plecoptera, and Trichoptera) was not abundantly found in both urban and suburban streams. Gastropoda was dominant in the urban streams. Chironomidae, Oligochaeta, and Libelludidae were abundant in both the urban and suburban streams.

CAN DNA BASED MONITORING OF MACROZOOBENTHOS DELIVER ABUNDANCE DATA? TESTING PRIMER BIAS AND BIOMASS - SEQUENCE RELATIONSHIPS WITH A NOVEL METABARCODING PROTOCOL

Elbrecht, Vasco; Leese, Florian

103C
Wednesday, 20 May, 2015 11:30 - 11:45

Metabarcoding combines DNA barcoding with next generation sequencing to reliably identify hundreds of specimens at once. However, detection rates in species-rich invertebrate samples as well as the capability to quantify biomass or species abundances have not been tested. We developed a novel Cytochrome c Oxidase 1 metabarcoding protocol and performed two controlled Illumina MiSeq experiments (each with 10 replicates). In the first experiment we used 31 specimens of a single stonefly species that differed across four orders of magnitude in biomass. We found a clear biomass - sequence abundance relationship but even smallest specimens were reliably detected. In the second experiment recovery of 52 different freshwater invertebrate taxa was tested using similar biomass as templates. With a single primer pair we could recover 83% of the taxa. However, sequence abundance varied by four orders magnitudes between taxa. Our experiments show that although biomass can be estimated if single species are present in a sample, reliable estimates from environmental samples are impossible due to primer bias. Thus, DNA-based ecosystem assessments should rely on presence-absence rather than abundance data.

MEASURING SEDIMENT LOADING AND RETENTION IN A LARGE URBAN HARBOR USING IODINE-131 IN TREATED SEWAGE EFFLUENT

Montenero, Michael; Waples, James

102C
Wednesday, 20 May, 2015 11:30 - 11:45

Non-point source loading from rivers is a major source of soil, nutrients, and contaminants in receiving water bodies. Material flux estimates to downstream waters are typically derived from watershed or river discharge measurements. Storage of material in the river or river terminus, however, is rarely considered. In this study, we estimate loading and retention of material in the Milwaukee Outer Harbor (area: 4.4 km2) using iodine-131 (half-life: 8 days) – a common radiopharmaceutical found in treated sewage effluent. In July of 2014, sediment loading from the Milwaukee, Menomonee, and Kinnickinnic Rivers (watershed: 2590 km2) was estimated at ~ 200 MT/day. Approximately 40 MT/day (20 %) of the sediment load was at least temporarily retained in the outer harbor. Both iodine-131 derived estimates of sediment loading and retention are consistent with independent estimates of combined river sediment discharge and sediment dredging from the Milwaukee Harbor.

SHORELINE HARDENING ALTERS THE STRUCTURE AND FUNCTION OF LAND-WATER INTERFACES

Wensink, Stacey; Tiegs, Scott

103AB
Wednesday, 20 May, 2015 11:30 - 11:45

Shoreline hardening is a widespread anthropogenic activity at terrestrial-freshwater interfaces worldwide, and these altered shorelines might be considered ‘novel ecosystems’ that bear little resemblance to their natural counterparts. We compared morphology, organic-matter dynamics, and invertebrate communities in terrestrial and aquatic habitats of natural and riprap-hardened shorelines of Lake St. Clair (Michigan, U.S.A.). In terrestrial shoreline habitats, organic matter decomposed faster on natural shorelines than on riprap. In aquatic habitats, however, decomposition rates were similar between shoreline types. Natural shorelines contained 3.5x more wrack than riprap shorelines in summer, 6x more in fall, but similar quantities in spring. The finding that natural shorelines contained more wrack despite faster decomposition suggests that wrack retention is impaired by riprap. Invertebrate community composition also differed between terrestrial habitats of natural and riprap shorelines. Exotic taxa were abundant and included European isopods, Asian earthworms, cyanobacteria (Lyngbia), and Phragmites. Riprap shorelines were steeper, drier, and had larger sediments, differences that may mediate organic-matter dynamics. Overall, riprap-hardened shorelines differ greatly from natural shorelines, particularly in terrestrial habitats, and possess attributes that qualify them as novel ecosystems.

INTERACTIONS BETWEEN CONSUMERS AND STREAM FUNCTIONAL PROCESSES: A CASE STUDY FROM THE PACIFIC NORTHWEST

Argerich, Alba; Penaluna, Brooke

103DE
Wednesday, 20 May, 2015 11:30 - 11:45

Stream function, including stream metabolism, nutrient uptake, and primary production, are influenced by the presence of fish and amphibians through direct and indirect processes. It is unclear, however, how consumer densities of fish and amphibians exert an effect on stream function and whether these processes change among scales. Here we present results from a field experiment conducted in a 4th-order stream in the H.J. Andrews Experimental Forest (Cascade Range, Oregon, USA). We examined the variation in stream functional processes at a reach- and patch-scale by manipulating consumer densities of resident Coastal Cutthroat Trout, Paiute Sculpin, and Coastal Giant Salamander under natural, depleted, and augmented levels over 34 days. By the end of the experiment, the reach with depleted consumer densities showed decreased algal biomass, Chl a, and nutrient uptake capacity. In contrast, nutrient uptake capacity, algal biomass and Chl a increased in the reach where added consumers. Overall, our findings indicate that large aquatic consumers affect stream functional processes and that the magnitude of the change is density-dependent and mediated by changes in the macroinvertebrate community.

THE EFFECT OF URBANIZATION ON THE WEB SPINNING BEHAVIORS OF RIPARIAN ORB-WEAVING SPIDERS

Sanchez, Jose; Kelly, Sean; Ramírez, Alonso

102B
Wednesday, 20 May, 2015 11:30 - 11:45

Urban streams are known to be heavily impacted by elevated concentrations of nutrients and pollutants. These aquatic ecosystems not only represent a source of energy for riparian consumers, but also a source of contaminants through bioaccumulation from consuming emerging aquatic insects. The web-building behavior of spiders has been used as a bioindicator for environmental contaminants due to changes in web features that can be linked to neurological effects caused by pollutants. In this study we evaluated the effect that urbanization, and its possible associated pollutants, have on the web-building behavior of Tetragnatha boydi. Tetragnatha is a genus of web-building spiders known to be specialists of aquatic ecosystems and are major consumers of aquatic insects. We selected five study sites along an urban gradient within the Río Piedras watershed in San Juan, Puerto Rico. Webs were photographed in the field and we later analyzed web structure variables (e.g., radii length, capture spiral length). We found significant differences for some web parameters among different sites, which indicate possible effects from contaminants associated with differences in surrounding urban density.

THE RESPONSE IN MACROINVERTEBRATE COMMUNITIES TO FLOOD DISTURBANCE IN URBAN RESTORED SYSTEMS

Henderson, Sara; Clinton, Sandra

101B
Wednesday, 20 May, 2015 11:45 - 12:00

Flooding is an important disturbance that structures stream communities. While flooding is investigated in a diversity of freshwater ecosystems, there are fewer studies focused on urban streams. Understanding macroinvertebrate post-flood dynamics is important for informing key ecosystem processes like food web dynamics and organic matter processing in these systems. The objective of this research is to quantify changes in macroinvertebrate populations in urban restored streams following flood events. We chose four streams in the Charlotte, NC area and monitored each stream's flood response for one year using six storms. Abundance trends reflected other published disturbance studies with a 66% increase ten days post-flood. We also found that restored sites recover in ways more similar to each other than to the unrestored reference site. Resistance and resilience of organisms was compared between sites and patterns emerged. Resistance was weaker in three restored sites shown by their inability to withstand small storms and stronger in the unrestored forested reference. Resilience was stronger in restored sites shown by their sometimes rapid recovery of organism abundance.

METAL CONCENTRATIONS DECLINE BY AN ORDER OF MAGNITUDE DURING METAMORPHOSIS IN THE MAYFLY (BAETIS TRICAUDATUS)

Wesner, Jeff; Walters, David; Schmidt, Travis; Kraus, Johanna; Wanty, Richard; Stricker, Craig; Clements, William

103AB
Wednesday, 20 May, 2015 11:45 - 12:00

Insect metamorphosis can reduce contaminant concentration and alter chemical tracers with potential consequences for food web and contaminant studies. We exposed larval mayflies (Baetis tricaudatus) to aqueous zinc in the lab (3 to 340 ug/L) and measured the change in zinc concentration and stable isotopes of larvae, subimagos, and imagos. Larval zinc concentrations varied ~9-fold across the gradient, but were only marginally related to aqueous zinc. Mayflies lost ~82% of their larval zinc during the transition to subimago. Zinc was also lost during the transition from subimago to imago, but only in high zinc environments. Further, ?15N increased during emergence, while ?13C declined. These results suggest substantial chemical changes during metamorphosis. Intriguingly, mayflies in high zinc environments required a two-stage depletion process in which most zinc is lost during metamorphosis from larva to subimago, and the rest is lost during metamorphosis from subimago to imago.

DECREASED TRAIT DIVERSITY OF MACROINVERTEBRATE COMMUNITIES WITH INCREASING IMPERVIOUS SURFACE COVER

Barnum, Thomas; Williams, Meghan; Weller, Donald

102B
Wednesday, 20 May, 2015 11:45 - 12:00

Macroinvertebrates in streams can be very sensitive to catchment urbanization, particularly to the presence of impervious surfaces. Recent research shows that many macroinvertebrate taxa do not persist in streams in catchments with >2% impervious surface. However, some studies suggest that alpha diversity does not decline with increasing impervious surface coverage. The loss of sensitive macroinvertebrate diversity could result in the loss of taxa with unique traits, yielding a loss of trait diversity from stream communities. We examined the relationship of functional trait richness as well as alpha diversity of the macroinvertebrate community to the percentage of impervious surface near the sampling site for stream reaches sampled by the Maryland Biological Stream Survey between 2007 and 2013. There was no relationship between alpha diversity and impervious surface ($P = 0.52$), but there was a negative relationship between functional trait richness and impervious surface ($P = 0.025$), suggesting that increasing percentages of impervious surface can drive declines in trait diversity within a community, even as alpha diversity remains unchanged.

EXPLORING THE IMPACT OF DIDYMOSPHENIA GEMINATA NUISANCE GROWTHS ON JUVENILE ATLANTIC SALMON

Gillis, Carole-Anne; Bergeron, Normand E.

101A
Wednesday, 20 May, 2015 11:45 - 12:00

Since 2006, nuisance growths of the diatom Didymosphenia geminata (didymo) have occurred in the Restigouche River system in eastern Canada. These dense mats have shifted macroinvertebrate community structure and prey abundance for juvenile Atlantic salmon (JAS). To understand the impacts of didymo on JAS, we assessed its effect on prey production, location, and availability. In parallel, we outlined the impact of mats on prey-predator interactions, habitat selection, and growth rates of JAS. Increasing didymo coverage lead to a significant positive relationship between proportions of benthic forays vs. drift forays ($R2 = 0.54$, $p < 0.001$). This shift in foraging behavior was not triggered by limited drifting prey availability. Isotopic signatures of JAS in didymo-affected sites suggest that these consumers have a more depleted diet than those in didymo-free sites. As for habitat selection, JAS site fidelity is sustained with increasing didymo cover. JAS daily weight gain is significantly lower in didymo-affected sites than didymo-free sites ($p < 0.001$). Underlying mechanisms by which D. geminata alters Atlantic salmon habitat will be discussed and the importance of thresholds dynamics will be highlighted.

HYPORHEIC COMMUNITY COMPOSITION IN A GRAVEL-BED HEADWATER STREAM OF NORTH-WEST ALGERIA: INFLUENCE OF HYDROLOGICAL EXCHANGE, SEDIMENT STRUCTURE AND PHYSICOCHEMISTRY

Taleb, Amina; Belaidi, Nouria

102DE
Wednesday, 20 May, 2015 11:45 - 12:00

The influence of hydraulic exchange patterns, subsurface sediment composition and interstitial physicochemistry on hyporheic invertebrate community composition was examined in four semi-arid headwater streams of North-West Algeria. We measured monthly, vertical hydrological gradient (VHG), dissolved oxygen, water temperature, PH and conductivity using mini-piezometers, each installed in a different upwelling or downwelling zone. Sediment samples and organic matter were taken along each piezometers on each date. The structure and functional organisation of hyporheic macroinvertebrate assemblages in pool and riffle bed streams were compared over summer and winter. Multivariate analyses revealed macroinvertebrate assemblages differed significantly between streams, geomorphology habitats and seasons. The hyporheos was numerically dominated by Cyclopoidae (permanent hyporheos), Gammaridae, Tubificidea, Chironomidae (occasional hyporheos), and subterranean asellidae isopods with high abundance. Species diversity (Shannon–Weaver) and taxonomic richness was significantly higer ($P < 0.05$) in down-welling zones than up-wellings, because more epigean taxa were present. Species diversity and taxonomic richness were lowest in up-wellings where hypogean animals dominated the hyporheic fauna.

SPATIAL AND TEMPORAL VARIABILITY IN BENTHIC INVERTEBRATE ASSEMBLAGES IN UPPER KLAMATH LAKE, OREGON

Stauffer, Natalie

101CD
Wednesday, 20 May, 2015 11:45 - 12:00

Upper Klamath Lake (UKL) is a shallow, hypereutrophic lake in southern Oregon, where excessive nutrient loading leads to Aphanizomenon flos–aquae blooms and poor water quality. We determined the distribution of benthic invertebrates in 3 geographic regions (north, central, and south) and 2 habitats (littoral and open-water). Samples were collected in May, June, and July 2013 using a modified Ekman grab and sieved at 500 µm. Invertebrate density in littoral and open-lake habitats was consistently high (mean=12,745 inds/m2 ±7,934 S.D.; n=54) with oligochaetes, chironomids, and leeches representing 97% of all individuals. Two-way repeated measures ANOVAs were used to identify differences in invertebrate densities among times, locations and habitats. There were no differences in total density among periods; however, leech densities were lower in May than in June and July and oligochaete densities were higher in May and June than in July. Total density was higher in littoral compared to open-water and in the northern location compared to the central or southern. Variation in invertebrate populations likely leads to variable nutrient loading from excretion and bioturbation that potentially influences algal blooms.

IS INCREASING HYPOXIA IN OUR FUTURE? THE EVOLUTION OF GREEN BAY'S DEAD ZONES

Klump, Val; LaBuhn, Shelby; Koopmans, Dirk; Bravo, Hector ; Hamidi, Sajad; Waples, James

102C
Wednesday, 20 May, 2015 11:45 - 12:00

With a long history of hypereutrophication, summertime bottom water oxygen depletion has been a long standing problem in Green Bay, Lake Michigan, but with little understanding of the dynamics driving it. Monitoring suggests the hypoxic phenomenon is highly variable, a complex result of geographic morphology, wind driven circulation, thermal stratification, water mass exchange with Lake Michigan, and the respiration of labile organic matter rapidly transported to the sediment-water interface. Benthic respiration is the major sink for oxygen in this system, and we are attempting to understand the extent and duration of hypoxia through experimental methods and tracer studies designed to quantify flow patterns, water column mixing and residence times, sediment oxygen demand, short term organic matter deposition, and apparent oxygen utilization rates. Projected warming may extend the stratified period by as much as several weeks, a change that could exacerbate hypoxia and confound management efforts to improve water quality. Models under development will link watershed loading to the biogeochemical and hydro-dynamics of the bay in order to estimate the impact of changing future conditions.

102A & South Foyer
Wednesday, 20 May, 2015 13:30 - 16:00

The Taxonomy Fair at the Annual Society for Freshwater Sciences meeting is an opportunity for students and professionals alike to interact with leading experts in the fields of invertebrate and algal taxonomy. The Technical Issues Committee has gathered over 10 experts in taxonomy and systematics to assist participants in difficult and unique taxa. Taxonomic experts will gather at the Taxonomy Fair during the Wednesday evening poster session. Please bring your difficult, unknown or interesting specimens to the taxonomy fair and have them verified by experts in the field. This is an opportunity to discuss your findings with other taxonomists, collaborate on new research and learn about new advances in systematics. The Taxonomy Fair is an open session allowing for intimate one on one interaction with taxonomic experts.

ENVISIONING FRESHWATER FUTURES

Carpenter, Stephen R.

Ballroom ABC
Thursday, 21 May, 2015 09:15 - 10:00

Freshwaters have never been more important to human well-being. Global policy analyses center on the energy-food-water nexus as the key to sustainability. Yet climate change, hydrologic flow modification, land-use change, chemical inputs, invasive species and harvest are causing massive transformations of freshwater ecosystems and losses of the benefits that they could provide to society. Underlying causes are complex. There is great uncertainty about the efficacy of policies and interventions to protect or restore freshwater ecosystems. Scenarios that employ stories, art and models are one way to assess uncertainty and evaluate options for management of complex systems. The talk will sketch an overview of scenario processes for freshwater ecosystems and present an example from a Wisconsin watershed.

PATTERNS OF LURE DISPLAY AND ASSOCIATED BEHAVIORS IN LAMPSILIS CARDIUM

Cox, Erin; Levine, Todd

102DE
Thursday, 21 May, 2015 10:30 - 10:45

A prominent aspect of unionid mussel life histories is their obligate parasitic phase, during which they attach to various fishes. Some mussels produce elaborate lures that presumably increase infestation success on hosts. We observed the behaviors associated with mantle lure display in a population of Lampsilis cardium near Mukwonago, WI. We made 764 observations of 40 mussels on 9 days during summer 2014. We created categorical descriptions of lure display, which ranged from 0 (no display, closed valves) to 5 (fully open valves with an active display). Overall mean lure rank was 2.11, with the highest lure display ranks in the morning (6 am) and evening (6 pm) with a longer display period in the evening. Preliminary analysis of burrowing data suggest that mussels do not necessarily move up in the substrate during display periods. Few data have been collected to describe diel lure display cycles, though this is likely to be an important in determining infestation success.

INFLUENCE OF SUBSTRATE SIZE AND BIOFILM GROWTH ON ANOMALOUS SOLUTE TRANSPORT IN EXPERIMENTAL STREAMS AT ND-LEEF

Aubeneau, Antoine; Tank, Jennifer L.; Hanrahan, Brittany; Bolster, Diogo

102B
Thursday, 21 May, 2015 10:30 - 10:45

In alluvial systems, biofilms grow on solid surfaces in benthic and hyporheic regions where they process dissolved solutes. Biofilms alter substrate characteristics and can change dynamics in porous space. We hypothesized that biofilms would increase solute residence time distributions (RTD) in benthic and (micro)hyporheic regions. Using experimental streams at Notre Dame's Linked Experimental Ecosystem Facility (ND-LEEF), we had four different substrate configurations: two homogeneous sediments (all pea gravel vs. all coarse gravel) and two heterogeneous sediments (alternating sections of each vs. well-mixed, 50/50 distribution). We measured the RTDs of the rhodamine-WT tracer multiple times over 5mo of biofilm colonization and growth. We found that as biofilm growth increased, the power-law exponent of the RTD decreased, with the tails of the distributions becoming heavier, suggesting prolonged retention in the presence of biofilms. Although the underlying substrate signature persisted over time, with coarse gravel streams clearing faster than streams with pea gravel, all streams had a similar pattern of the power-law exponent decreasing over time as biofilm developed. These results emphasize the dynamic relationship and feedback between the physical and biological environments.

CITIZEN SCIENCE AND RESOURCE MANANAGEMENT

Jordan, Rebecca; Sorensen, Amanda

103AB
Thursday, 21 May, 2015 10:30 - 10:45

It is clear that citizen science programs result in a vast array of ecological and social outcomes. Positive outcomes recently reported in the literature include advancing conservation goals and increasing socio-ecological stewardship. In this talk, I will discuss learning gains and the development of epistemic practices (i.e., knowledge about the knowledge produced in citizen science) in the context of socio-ecological outcomes. In particular, I will use data from the citizen science program: CollaborativeScience.org. I report that the act of participation in data gathering in socio-ecologically framed citizen science projects can: (1) Increase individual efficacy to drive community outcomes; (2) Help to build trust among members of similar or different communities that share goals; (3) Enable communication between the public and decision-makers; and (4) Through the act of modeling, promote an increase in scientifically related epistemic practices. I will conclude with a discussion about project assessment based on decision-making success.

CUMULATIVE EFFECTS AND CUMULATIVE EFFECTS ASSESSMENT: ROLES FOR FRESHWATER SCIENTISTS

Somers, K.; Jones, Chris; Bailey, John

101CD
Thursday, 21 May, 2015 10:30 - 10:45

Renewed interest in quantifying cumulative effects follows from collaborations involving land-use planning, environmental assessment, biomonitoring, and eco-toxicology. The general concepts and various policy and legislative provisions set the stage for cumulative effects assessments. Given the many different definitions and philosophies, the applications of cumulative effects often diverge to the point of being contradictory. This special session high-lights current practice where cumulative effects are evaluated within the context of single and multiple environmental stressors and integrative biological effects. This presentation describes a general policy and legislative framework that is combined with examples of current practice to highlight where freshwater scientists can contribute and strengthen the scientific basis for assessing cumulative effects.

PRESENT STATUS AND FUTURE PROSPECTS OF FRESHWATER BIOLOGY RESEARCH IN SOUTH ASIAN COUNTRIES

Nair, Achuthan

101A
Thursday, 21 May, 2015 10:30 - 10:45

South Asian countries viz. India, Pakistan, Afghanistan, Sri Lanka, Maldives, Nepal, Bhutan and Bangladesh decided to co-operate with each other and established the South Asian Association for Regional Co-operation (SAARC) in the 1980's. SAARC is supposed to provide policy advice and capacity building services for its freshwater research program. Unfortunately these are not available for various reasons. South Asia is blessed with rivers, lakes, streams and ponds and research on various aspects of freshwater biology started in the 1970's. However, almost all studies are independent, there is no co-ordination and everything moves aimlessly. This must stop. Instead, there must be a common coordinated approach from the concerned countries. Coordination should begin with establishment of a South Asian Research Center on Freshwater Biology which conducts research, organizes workshop and training programs, publishes documents and provides advisory services. The Center can also coordinate research activities in South Asian countries and help exchange information among member states. The SAARC Secretariate, governments and funding agencies can help establish this Center.

THE EFFECT OF DISPERSAL BARRIERS ON STREAM FISH AND INSECT ASSEMBLAGES IN URBAN LANDSCAPES

Smith, Robert; Roy, Allison

101B
Thursday, 21 May, 2015 10:30 - 10:45

The urban stream syndrome describes the numerous, potentially interacting pathways that urbanization alters stream ecosystem structure and function. Human-altered landscapes can also fragment natural habitats, create environmental sinks, and include direct barriers to movement that affect dispersal. We examined the ability of land use/cover in the catchment and features of the broader landscape that affect dispersal (e.g., road crossings, impervious cover) to predict the composition of fish and insect assemblages in streams along an urbanization gradient in Massachusetts. We divided the catchment and broader landscape into overlapping and non-overlapping sections for analysis to minimize the effect of spatial autocorrelation of land-use variables among spatial extents. We compared model fit of regressions of individual landscape predictors and community response variables across multiple spatial scales to determine the spatial scale for analysis. We found that catchment land use had a greater effect on assemblage variables than landscape variables representing dispersal barriers. However, landscape variables were also significant predictors, suggesting that features affecting dispersal may be important drivers of fish and macroinvertebrate assemblages and may be useful to guide land conservation decisions.

BASEFLOW PATTERNS OF GEOMORPHIC HETEROGENEITY IN STREAM NETWORKS ACROSS BIOMES

Rueegg, Janine; Sheehan, Ken; Baker, Christina; Daniels, Melinda; Dodds, Walter; Farrell, Kaitlin; Flinn, Michael; Gido, Keith; Harms, Tamara; Jones, Jeremy; Koenig, Lauren; Kominoski, John; McDowell, William H.; Bowden, William; Rosemond, Amy D. ; Trentm

103C
Thursday, 21 May, 2015 10:30 - 10:45

Using geomorphology to predict ecological processes in streams is challenging, in part, because geomorphological studies typically describe bankful flow channel morphology rather than baseflow conditions that prevail most of the time. We surveyed selected baseflow geomorphic metrics throughout five stream networks spanning subtropical rainforest to arctic tundra biomes. We measured canopy cover, width, depth, and sediment size at transects in reaches covering the discharge gradients in each network and hypothesized that structural heterogeneity was higher at smaller scales and patterns of heterogeneity within networks were biome-specific. Nested ANOVAs revealed significant differences among biomes for all variables except sediment size, while reaches within biomes differed significantly for all metrics. Biome accounted for most variation in canopy cover and reaches accounted for most variation in width, but a large portion of variation in depth and sediment size remained unexplained by either. Geomorphic characteristics were predicted by upstream drainage area within biomes, but the functional form (e.g., power or logarithmic) and parameters depended on both metric and biome. Surveys of baseflow geomorphic patterns may increase our ability to scale ecological processes they structure.

EVOLUTIONARY DELINEATION AND CRYPTIC SPECIATION OF HYALELLA SPP. IN THE CHIHUAHUAN DESERT

Williams, Trevor

103DE
Thursday, 21 May, 2015 10:30 - 10:45

Vicariance-based speciation is an evolutionary process that has occurred in many freshwater systems. Aquatic invertebrates are especially prone to this type of speciation due to low dispersal ability, often forming cryptic species complexes. The amphipod Hyalella is widespread throughout all of North America, including the Pecos River drainage in the Chihuahuan Desert. We hypothesize that individual spring systems within this basin hold endemic, cryptic species of Hyalella. We also hypothesis that divergence will follow the stream hierarchy model and increase with river distance. To test these hypotheses we sequenced two mitochondrial genes (cytochrome oxidase subunit I and 16s rRNA) and one nuclear gene (28s rDNA), created a phylogeny, and calculated genetic divergence. Our results supported the presence of cryptic species by identifying five possible species. However, genetic variation did not follow the patterns expected in an isolation-by-distance model. This may be due to high mutation rates or greater dispersal abilities than previously expected. Populations of Hyalella exhibit great levels of genetic diversity and endemism in the Chihuahuan Desert; the presence of cryptic species with limited ranges merits conservation concern.

EFFECTS OF SHORT-ROTATION PINE MANAGEMENT FOR BIOENERGY ON WATER QUALITY IN THE SOUTHEASTERN UNITED STATES

Griffiths, Natalie A.; Jackson, C. Rhett; McDonnell, Jeffrey J.; Bitew, Menberu; Du, Enhao; Klaus, Julian

102C
Thursday, 21 May, 2015 10:30 - 10:45

We are examining the effects of growing loblolly pine for bioenergy on water quality using a watershed-scale experiment. We measured nitrate, ammonium, and soluble reactive phosphorus (SRP) in stream water, groundwater, shallow subsurface flow, and throughfall in 3 adjacent, forested watersheds at the Savannah River Site (near Aiken, South Carolina). Baseline conditions were measured for 2 years (2010-2012), and in 2012, the treatments were imposed in 2 of the watersheds, with the third watershed serving as an unmanipulated control. Forty percent of the treatment watersheds were harvested in 2012, pine seedlings were planted in 2013, and herbicides and fertilizers were applied annually. Groundwater is the predominant flowpath in these low-relief watersheds, and nitrate concentrations increased in groundwater (up to 2 mg N/L) post-treatment. Nitrate concentrations have not increased in riparian zone groundwater or stream water, suggesting that elevated nitrate has not reached the streams, or has been taken up or denitrified along the flowpath. Ammonium and SRP concentrations have not increased in groundwater or stream water. Future work will estimate groundwater transit times and measure denitrification in these watersheds.

BLACK FLIES FROM BACKYARDS: INCORPORATING CITIZEN DERIVED DATA INTO THE STUDY OF NUISANCE INSECT DISTRIBUTION

Wilson, Rebecca; Leslie, Alan; Spadafora, Elanor; Shaffer, Jen; Lamp, William

103AB
Thursday, 21 May, 2015 10:45 - 11:00

Data collected by citizens and university researchers were used to determine the species and distribution patterns of the nuisance black flies (Diptera: Simuliidae) in western Maryland. Citizen collected specimens and survey replies were used to determine the nuisance species, the extent of the problem, and resident perceptions of the flies. Collection kits were distributed to resident volunteers in 2013 and 2014 for the purpose of determining the species, and a survey was posted on www.mdblackfly.com throughout both years. Researchers from the University of Maryland sampled adult and larval specimens to determine the breeding source and the spatial factors influencing fly distribution. All black flies collected by residents were Simulium jenningsi, a pest found throughout the Mid-Atlantic. Larvae sampled indicated the Potomac River as the primary breeding site. Quality of collected adult specimens varied greatly between volunteers, however the majority of black flies were intact and identifiable to species. Survey replies indicated highly reduced quality of life due to the swarms in the Pleasant Valley region of Washington County.

FRESHWATER RESEARCH IN MALAYSIA

YULE, CATHERINE

101A
Thursday, 21 May, 2015 10:45 - 11:00

Despite publication of Yule and Yong (2004) Freshwater Invertebrates of the Malaysian Region, studies of Malaysian freshwaters are still uncommon. Most local research involves pollution studies and biodiversity surveys despite paucity of taxonomic research (relatively few invertebrate species are described). Our research focuses on ecosystem function of: tropical peatswamps; streams in different forest types (e.g. dipterocarp, heath, limestone, montane); and urban streams, particularly through studies of litter decomposition and food webs. We use Next Generation Sequencing to study microbial metagenomics, DNA barcoding and phylogenomics. We participate in world-wide collaborations comparing tropical vs temperate aquatic ecosystem processes, and have made novel discoveries regarding ecosystem functioning, microbial ecology and new species (e.g. aquatic microbes, algae, insects). Regional peatswamps are of global importance due to immense carbon sequestration (in peat up to 25 m deep). Ongoing peatswamp destruction by logging, drainage and fire – mostly for oil palm plantations –causes carbon releases >10% of world fossil fuel emissions. Understanding ecosystem processes involved in peat formation, degradation and carbon emissions is vital for the protection and rehabilitation of peatswamps and mitigation of climate change.

DOES URBAN TREE CANOPY ENHANCE NUTRIENT EXPORT BY STORMWATER?

Janke, Benjamin; Finlay, Jacques; Hobbie, Sarah

101B
Thursday, 21 May, 2015 10:45 - 11:00

Development of urban tree canopy is often prescribed as a stormwater management strategy due to the ability of trees to reduce stormwater volumes through interception of rainfall. However, trees also potentially contribute to nutrient export in stormwater through deposition of leaf litter onto streets, which are usually directly connected to storm drainage networks and therefore to receiving lakes and streams. We address the potential influence on stormwater nutrient fluxes of tree canopy over and near streets through analysis of high-resolution land cover data and several years of water quality monitoring data for several primarily-residential urban watersheds across Minneapolis-St. Paul, MN. We find a positive correlation between canopy cover over streets and stormwater phosphorus and suspended solids across watersheds. At the smaller scale of a 20-ha residential watershed, we illustrate the importance of tree species and canopy coverage of impervious surfaces through sampling of catch basins and rainfall-runoff in gutters of individual blocks. The results imply that urban water quality management may need to consider tree species selection in managed boulevards as well as improved timing of street sweeping.

CHALLENGES IN A RETROSPECTIVE STRESSOR ANALYSES OF A LONG TERM SURVEILLANCE DATA SET

robinson, wayne

101CD
Thursday, 21 May, 2015 10:45 - 11:00

I discuss some issues associated with using a large spatial scale (1million Ha) and medium temporal scale (9 year) surveillance monitoring data set in a retrospective manner. The fish community data collected for the ‘sustainable rivers audit’ in the Murray Darling Basin, Australia, meet extremely high quality control and quality assurance standards, and were collected in a well-design probabilistic sampling strategy. However, they are not designed for stressor or impact type assessments and even a simple retrospective analysis must consider complex interactions and assumptions. For example, I present a hierarchial analysis looking at responses by fish to changes in rainfall or river levels and show that the natural spatial extent (species distributions) account for the majority of variability in the data set. Ultimately, the data are only reasonably interpretable when either spatial or temporal variability are simplified (e.g. looking at small spatial or temporal scale changes). I present some challenging problems with this type of data set and hope to use the session to gain input from other researchers facing similar issues with data not designed specifically for stressor assessments.

ECOLOGICAL DIFFERENTIATION IN A FRESHWATER MUSSEL SPECIES COMPLEX

Walters, Ashley; Inoue, Kentaro; Harris, John; BERG, DAVID

103DE
Thursday, 21 May, 2015 10:45 - 11:00

Obovaria jacksoniana and Villosa arkansasensis form a complex consisting of five clades in the lower Mississippi and Gulf Coast drainages. We used Maxent to create habitat suitability maps for the complex as a single species, for the two morphologically defined species, and for each of the five clades. We compared model fit among these taxonomic groupings and examined correlations among divergence time and niche overlap for pairs of clades using Mantel tests. Niche models for the five separate clades provided the best model fit. Models for each clade were significantly different from one another. We found a negative correlation between divergence time and niche overlap; thus, clades that diverged most recently occupied the most-similar niches. Recent speciation within this complex, likely due to geographic isolation, appears to have been accompanied by niche differentiation. Rather than two species, this complex consists of five species that are distinguishable both genetically and ecologically. While providing insight into the process of speciation, our study suggests that niche differentiation may be a useful measure for identifying taxonomic units of conservation interest.

TURBULENT HYPORHEIC EXCHANGE IN PEMEABLE SEDIMENTS

Roche , Kevin ; Packman, Aaron

102B
Thursday, 21 May, 2015 10:45 - 11:00

Solute delivery from the water column into a streambed strongly influences metabolism in rivers. Current hydrological models simplify surface-subsurface (hyporheic) exchange by treating each domain separately, constraining turbulent flows to the water column. Studies have shown, however, that turbulence penetrates into permeable sediments. Evidence is lacking for how this highly coupled flow regime influences hyporheic exchange.

AN EXPLORATION OF CONVERGENT EVOLUTION IN ACADEMIA: WHY ECOSYSTEM ECOLOGISTS AND BIOGEOCHEMISTS SHOULD THINK ABOUT THE TOOLS OF SOFTWARE ENGINEERING

Payn, Robert; Izurieta, Clemente; Poole, Geoffrey

102C
Thursday, 21 May, 2015 10:45 - 11:00

The fundamental abstractions of computer science and ecosystem ecology have evolved to be remarkably similar, despite differences in semantics. Ecosystem ecologists study the interactions of “structure” and “function” within ecosystems, while software engineers design “attributes” and “methods” when coupling classes in object-oriented software. Engineers have established a rigorous toolkit (Unified Modeling Language, UML) for organizing hierarchical ontologies of structure and function. We suggest these tools can be effectively applied to the organization of ecological concepts, which ultimately leads to more intuitive implementations of ecological models. In this presentation, we reconcile interdisciplinary semantics and present examples of ontological descriptions of ecosystems in UML, in order to demonstrate the potential value of software engineering tools to the organization of ecologic understanding. Furthermore, we present a working prototype of a hierarchical shared-state-space software abstraction that will facilitate linking qualitative models to quantitative predictions in a hypothesis testing environment. Sharing of state space is critical to the simultaneous application of multiple interdisciplinary hypotheses in the attempt to understand the social and ecological consequences of a changing environment.

TURNING A SNAPSHOT INTO A MOTION PICTURE: PATTERNS IN AQUATIC INSECT PRODUCTION ALONG A GRADIENT OF ALKALINE MINE DRAINAGE

Voss, Kristofor; Bernhardt, Emily

102DE
Thursday, 21 May, 2015 10:45 - 11:00

Traditional aquatic bioassessment studies typically quantify the numbers of taxa lost along anthropogenic gradients without addressing whether observed changes in community composition correspond to changes in functional properties within the ecosystem. To bridge this gap, we have conducted a study of community level secondary production in Central Appalachian streams whose chemistry has been altered by surface coal mining. To do so, we took monthly macroinvertebrate samples across a gradient of mining land-cover in Mud River, WV during 2012-2013. In agreement with previous studies, we observe a 39% decline in macroinvertebrate richness and a 37% decline in Shannon diversity along the gradient with patterns in nearly every month reflecting the same trend. More importantly, we observe similar monthly patterns in EPT richness which declines by 52% on average. Because these sensitive taxa exhibit episodic emergence throughout the year, their absence from the most degraded site results in a 50% compression of the seasonal variation found at the site unaffected by mining. We plan to report these patterns in both the absolute amount and seasonal variation of secondary production across the year.

USING A SENSOR NETWORK TO UNDERSTAND DRIVERS OF NUTRIENT AND ORGANIC MATTER CONCENTRATIONS AT MULTIPLE SPATIAL AND TEMPORAL SCALES

McDowell, William H.; Potter, Jody; Snyder, Lisle; Daley, Michelle; Appling, Alison; Koenig, Lauren; Rodriguez-Cardona, Bianca; Wymore, Adam; Brereton, Richard

103C
Thursday, 21 May, 2015 10:45 - 11:00

Understanding, predicting, and controlling water quality across multiple scales is an important goal in watershed management. Two solutes, nitrate and dissolved organic matter, are important for watershed management and can be effectively measured with in situ sensors. Here we report on 2-3 years of water quality data collected continuously at 9 stream and river sites in New Hampshire that span a range of land use. Extensive comparison of sensor results with traditional grab samples demonstrates that sensors can provide reliable estimates of nitrate concentrations; estimates of dissolved organic matter concentrations with sensors are less certain. Deconstruction of variability in nitrate concentrations shows that the greatest variability occurs at the scale of days to a week, with few streams showing strong seasonal patterns in nitrate concentrations or strong relationships with stream discharge. Diel patterns in dissolved oxygen and nitrate are surprisingly common, with clear patterns observed in both shaded headwater streams and larger rivers. Intensive monitoring in heavily developed watersheds shows much higher average nitrate concentrations but reduced variability at scales of minutes to days when compared to more rural watersheds.

USING STRUCTURAL EQUATION MODELING TO DETERMINE EFFECTS OF FISH PRESENCE AND ENVIRONMENTAL FACTORS ON STREAM BENTHIC BIOGEOCHEMICAL RATES

Trentman, Matt; Dodds, Walter; Gido, Keith; Rueegg, Janine; Ruffing, Claire

102C
Thursday, 21 May, 2015 11:00 - 11:15

Biogeochemical fluxes within streams can vary with local environmental conditions as well as variations in the distribution of fishes. We used structural equation modeling to elucidate direct and indirect effects of fish and other environmental factors (e.g. canopy cover, substrate size) on fine scale (300 cm2) benthic rates of ecosystem respiration (ER), gross primary production (GPP), and ammonium uptake in a prairie stream. We manipulated fish presence over some substrata with mesh exclosures prior to incubation. We measured biogeochemical rates of stream-equilibrated substrata (n=49) by monitoring fluxes of dissolved O2 (in light and dark) and ammonium inside sealed acrylic chambers with internal circulation systems. Total model-explained variance was highest for ER and lowest for GPP. Fish presence directly increased ammonium uptake and GPP, while all rates were indirectly affected through changes in either FBOM or chlorophyll a standing stocks. Significant paths of environmental factors varied with each model; however, wetted width was important for all rates. Separate analyses of fish exclusions and SEM models both agree that fish presence likely affects ammonium uptake, with less evidence for GPP.

PUTTING CONTAMINATION TO USE FOR REDUCING UNCERTAINTY IN ENVIRONMENTAL DNA MONITORING

Turner, Cameron R.

103DE
Thursday, 21 May, 2015 11:00 - 11:15

Genetic analysis of environmental DNA (eDNA) provides site occupancy inferences for rare aquatic macrofauna that are often easier to obtain than direct observations of organisms. Research on the origin, state, transport, and fate of environmental DNA (eDNA) from aquatic macrofauna is needed to describe the spatiotemporal context for eDNA-based occupancy inferences, and to guide eDNA sampling design. One often underestimated origin is contamination. Contamination sources, primarily PCR product and tissue, are abundant in most laboratories with interest and capacity to analyze eDNA. Unfortunately, standard precautions (i.e., autoclaving) are inadequate for destroying DNA contamination. Even worse, standard negative controls (i.e., water blanks) are inadequate for observing contamination occurrence and abundance. Having learned these old lessons the hard way, I present several case studies involving eDNA data that I ultimately concluded were best explained by contamination. These conclusions are supported by data from other fields making organismal inferences based solely on indirect genetic evidence from environmental samples: microbiology, forensics, paleogenetics, fecal source tracking, and agricultural transgene monitoring. Finally, I suggest a framework for accurately estimating contamination occurrence and abundance.

LIMITS OF TRANSIENT STORAGE ASSUMPTIONS FOR HEAT: USING RESIDENCE TIME DISTRIBUTION TO ESTIMATE MEAN TEMPERATURE OF HYPORHEIC DISCHARGE MONTANE ALLUVIAL STREAMS

Poole, Geoffrey; Amerson, Byron; Fogg, Katie; O'Daniel, Scott; Payn, Robert; Reinhold, Ann Marie; Izurieta, Clemente

102B
Thursday, 21 May, 2015 11:00 - 11:15

Hyporheic influence on channel temperature is most prominent in streams with expansive (hyporheic cross section >> channel cross section) coarse grained aquifers. We combined estimates of residence time distribution with a novel application of the advection-dispersion equation to calculate the mean temperature patterns of hyporheic discharge from expansive aquifers. Our results show that mean hyporheic discharge temperature is substantially different from the mean temperature of the hyporheic zone. Yet some transient storage models calculate solute or heat exchange between the channel and transient storage zone based on a mean concentration or temperature in the transient storage zone. Such an assumption may be reasonable for a small hyporheic zone, but misrepresents the influence of an expansive hyporheic zone on surface water temperature. Results from a prototype, quasi-1-D model -- which subdivides the hyporheic zone by residence time and simulates heat transfer among the sub-zones and the channel –- provides a more complete representation of hyporheic-channel heat dynamics in alluvial, montane streams.

DEVELOPING ECOLOGICAL INDICATORS FOR NUTRIENTS AND URBAN IMPACTS TO STREAMS IN COASTAL WATERSHEDS

Smucker, Nathan; Kuhn, Anne; Charpentier, Mike; Cruz-Quinones, Carlos; Elonen, Colleen; Hill, Brian; Lake, Jim; Serbst, Jonathan

101B

Thursday, 21 May, 2015 11:00 - 11:15

Increased nutrient loads associated with human activities are among leading causes of impairment to streams and receiving waterbodies. For streams draining to the environmentally and economically important Narragansett Bay estuary, we developed indicators based on (1) nitrogen and carbon stable isotope ratios of periphyton and macroinvertebrates and (2) microbial enzyme activities. Streams tended to be P limited, as indicated by nutrient concentrations and high microbial phosphatase activity that decreased as TP concentrations increased. Nitrate concentrations significantly increased with human sources associated with urban land cover. Increased nitrate concentrations were significantly correlated with greater δ15N in periphyton and macroinvertebrate scrapers, detritivores, and predators, making these potentially useful indicators that also provide insight into changes in food webs. Microbial respiration decreased as the ratio of glycosidases to oxidases decreased, potentially indicating lower quality of DOC in urban streams. Stable isotopes and macroinvertebrate communities indicated that vegetated riparian buffers likely had benefits for ecological communities, even in moderately urban streams. Lastly, landscape indicators are being developed using GIS to characterize how spatial patterns of land cover are linked to stream conditions.

MODELING WATER QUALITY AND BIOLOGICAL CONDITION IN STREAMS AT MULTIPLE SCALES: APPLICATIONS OF THE ENVIROATLAS DATASET

Paul, Michael; Cada, Peter

103C
Thursday, 21 May, 2015 11:00 - 11:15

Predictive models of water quality condition using landscape attributes are not novel; but, the USEPA EnviroAtlas, which provides landscape predictors at the NHD catchment scale for the CONUS, makes possible the analysis of landscape effects on water quality and biological condition at a variety of spatial scales (from headwaters to the entire CONUS), for a wide variety of novel attributes (traditional land cover to novel flow path lengths). Therefore, we developed a series of demonstrative predictive models of water quality and biological condition using the EnviroAtlas dataset at a variety of spatial scales. We used EnviroAtlas predictors and nutrient data from USGS/USEPA for sites across the CONUS and developed nutrient predictive models. Models identified both watershed and riparian predictors, but these varied with spatial scale and region. Novel flow path attributes demonstrated varied predictive behavior. We then developed models of biological condition from several state and national programs to predict deviation from mean condition. Again, predictors at the national and local scale varied, and novel predictors (such as flow path attributes) provide interesting insights.

USE OF WATERSHED-SCALE BIOLOGICAL MONITORING FOR RESTORATION PLANNING AND EVALUATION

Stribling, James

101CD
Thursday, 21 May, 2015 11:00 - 11:15

Prince George's County, located within Maryland's Coastal Plain, is drained by three major river basins: the Anacostia River, the Patuxent River, and the non-Anacostia portions of the Potomac River. It is home to approximately 880,000 residents with approximately 43 percent urban land use. Two rounds of county-wide bioassessments have been completed (Round 1, 1999-2003; and Round 2, 2010-2013). Using the Maryland DNR benthic index of biological integrity, assessments are provided at four spatial scales: site-specific, subwatershed, major basin, and countywide; aggregate indicators above the site scale, are presented as 'percent degradation'. Countywide, 52% of streams are biologically-degraded, with individual subwatersheds ranging from 14-83%. The County Department of the Environment (DOE) is in the process of responding to total maximum daily loads (TMDL) across various subwatersheds for biological oxygen demand, fecal coliforms, sediment, trash, polychlorinated biphenyls, and phosphorus. Subwatersheds are prioritized for restoration by percent impervious surface, structural and programmatic best management practices are being designed and implemented to control stormwater and other stressors and stressor sources, and biological condition (as percent degradation) is being used to document effectiveness.

DIY DIGITAL SOLUTIONS FOR PROMOTING AND SUSTAINING CITIZEN SCIENCE ENGAGEMENT IN FRESHWATER BIODIVERSITY AND HABITAT MONITORING

Burres, Erick

103AB
Thursday, 21 May, 2015 11:00 - 11:15

The Clean Water Team, California's citizen monitoring program, has successfully supported citizen monitoring of biodiversity and habitats, employing digital solutions, since 1999. To meet the demand for supporting, educating, and training volunteer-staffed programs, the Clean Water Team has been creating extremely useful and innovative digital tools, in house. This includes portable touch navigatable media rich solutions that function much like apps. In this presentation we will discuss the development, creation digital solutions by non-technical personnel using software your program/agency probably already have.

STREAM ECOLOGICAL RESEARCH OF TAIWAN: RETROSPECT AND PROSPECT

Wang, Yi-Kuang; Suen, Jian-Ping

101A
Thursday, 21 May, 2015 11:00 - 11:15

The monsoon rainfall and flashy hydrology characterize streams in Taiwan. Mountain streams are prone to erosion and land slide. This review primarily summarizes papers of Taiwan stream ecology published in SCI journals in the last decade. Masu salmon conservation led the development of stream ecological research in Taiwan. Fish, macroinvertebrates, and algal ecology were studied. Among taxa, fish was paid more attention. Ecohydrology studies were driven by widespread engineering structures in streams and environmental awareness. Bioassessment and biogeochemistry, major topics in western countries, were paid little attention in Taiwan. Future studies may emphasize life history of aquatic organisms, ecology of migratory fauna, ecohydrology, impacts of climate change, biogeochemistry, and bioassessment.

TOP DOWN AND BOTTOM UP INTERACTIONS IN WATER-FILLED TREE HOLES: IMPLICATIONS FOR MICROBIAL DIVERSITY AND MOSQUITO EMERGENCE

Norman, Beth; Ruhs, Alexander; Van Alst, Andrew; Walker, Edward

102DE
Thursday, 21 May, 2015 11:00 - 11:15

Water-filled tree holes provide larval habitat for many mosquito species, including vectors for several human diseases. Detrital inputs to tree holes in beech-oak forests include a mix of fresh and well processed leaves. Therefore, larvae are exposed to detritus at various stages of conditioning. Similarly, detritus-associated microbial communities are exposed to larval feeding at different stages of community assembly. We investigated the effects of leaf condition and ration on mosquito production under different larval densities in laboratory mesocosms. We also compared the effect of larval feeding on the structure of early and late stage microbial communities using next generation sequencing techniques. Preliminary data suggest that leaf condition and ration influence mosquito mass, emergence, and development time with generally heavier adults with shorter development times emerging from mesocosms with heavier rations of leaves in early conditioning stages. However, we found more interactions between leaf condition and ration when the density of larvae was increased. Mosquito success was generally reduced in mesocosms with well-conditioned leaves regardless of leaf ration.

UNDERSTANDING LAND USE AND CLIMATE IMPACTS ON WATER QUALITY ACROSS SPATIAL SCALES: INTERACTIONS OF SCALE, INTENSITY, DILUTION, AND ECOSYSTEM SERVICES (ISIDES)

Wollheim, Wil; Stewart, Robert; Mineau, Madeleine; Samal, Nihar; Zuidema, Shan; Huang, Tao; Zhou, Zaixing

103C
Thursday, 21 May, 2015 11:15 - 23:30

At regional scales, water quality is spatially varied and temporally dynamic due to interactions of upstream land use, hydrologic conditions, and aquatic processes. We apply a conceptual framework that synthesizes the factors controlling water quality across spatial scales, the iSIDES concept: impact=f(Scale * Intensity * Dilution * Ecosystem Services). We integrate this concept with a river network process-based model, the Framework for Aquatic Modeling of the Earth System (FrAMES), to understand spatial and temporal variability of water quality throughout the Merrimack River watershed. We simultaneously predict spatially distributed flow, water temperature, chloride, and dissolved inorganic nitrogen to understand their coupled responses at the regional scale. We find that wetter summers result in increased proportion of the river length above temperature thresholds for fish, reduced N removal, increased N export fluxes, but reduces the downstream extent of chloride impairment. We suggest that the iSIDES concept integrated with a process-based network model is helpful for understanding potential future water quality at regional scales as land use and climate continue to change.

VARIATION IN DISSOLVED NUTRIENTS AND GREENHOUSE GASES ALONG STREAM NETWORKS IN TWO WATERSHEDS OF CONTRASTING LAND USE

Dee, Martha M.; Tank, Jennifer L.; Beaulieu, Jake J.; Marzadri, Alessandra; Tonina, Daniele ; Bellin, Alberto

102C
Thursday, 21 May, 2015 11:15 - 23:30

Human activity has increased atmospheric greenhouse gasses, and streams may be important sources of carbon dioxide (CO2), methane (CH4), and nitrous oxide, which are responsible for the majority of heat trapping capacity in the modern atmosphere. Using 24hr synoptic sampling, we measured dissolved nutrients and gasses at 80 stream/river sites within two watersheds: the Manistee (MI) and the Tippecanoe Rivers (IN), which have contrasting agricultural land use (~17% vs 82% of area, respectively). During summer, dissolved nutrients varied spatially both within and among watersheds, ranging from 5-2490 ÂµgNO3-N/L, 6-73 ÂµgNH4-N/L and 4-41 ÂµgSRP/L in the Manistee, and from 10-4321 ÂµgNO3-N/L, 2-590 ÂµgNH4-N/L and 1-607 ÂµgSRP/L in the Tippecanoe. Additionally, dissolved CO2 and CH4 in the Tippecanoe were generally supersaturated, but the degree of saturation was significantly higher and more variable in tributaries (n=54) compared to the river mainstem (n=26). Based on preliminary data, we suggest that rivers may integrate spatial variation in nutrients and gasses from watershed tributaries. These data will be used to parameterize a watershed model linking dissolved nutrients to gas emissions as a function of land use.

IF YOU BUILD IT, WILL THEY COME? MACROINVERTEBRATE COMMUNITY COMPOSITION IN INDIANA TWO-STAGE DITCHES

Speelman, Julie; Holland, Jeffrey D.

102DE
Thursday, 21 May, 2015 11:15 - 23:30

Intense agricultural practices have negatively affected water quality both near the farming sources and thousands of miles downstream. Nutrient-rich subsurface drainage enters streams and causes hypoxia, influencing aquatic communities in Midwestern agriculture ditches. These effects also contribute to hypoxia in the Gulf of Mexico. Research has shown that two-stage ditches reduce nutrient transport to streams, however, little work has been published on the biological integrity of these ditches. The purpose of this research is to compare the aquatic invertebrate communities in two-stage ditches to conventional ditches in two Indiana counties where the major land use (>90%) is row crop agriculture. Sampling was performed at each two-stage ditch and paired with a nearby conventional drainage ditch. Composite samples were taken from the sediment and the aquatic vegetation. Artificial substrate samplers were also allowed to be colonized at each site for a period of six weeks. Results from this study will be used to further our understanding of the macroinvertebrate communities inhabiting drainage ditches as well as lead to the creation of a water quality index that can be used in monitoring.

EULERIAN VERSUS LAGRANGIAN PERSPECTIVES ON LIGHT AVAILABILITY IN A LARGE RIVER

Gardner, John; Ensign, Scott; Doyle, Martin; Neve, Ryan

102B

Thursday, 21 May, 2015 11:15 - 23:30

Large rivers have played a minor role in lotic ecosystem ecology historically dominated by streams. One limitation to studying rivers is methodological: Eulerian techniques developed in streams are effective for measuring benthic processes that influence well-mixed systems, but are inappropriate for measuring variability within the water column. As river size increases, the spatial scale of movement and environmental heterogeneity experienced by planktonic organisms increases, requiring a Lagrangian approach to measure exposure and response to environmental conditions. To explore the difference between Eulerian and Lagrangian approaches, we examined light within the water column of a large river (Neuse River; Q = 68 m3 s-1 during study) using an autonomous, neutrally-buoyant Lagrangian drifter (HydroSphere, Planktos Instruments) combined with stationary Eulerian sensor nests. The drifter cycled constantly throughout the water column while traversing 42 km of river in 24 hr; Lagrangian light intensity was twice as variable compared to sensor nests (Eulerian) bracketing the reach. By measuring this Lagrangian variability in light and travel time we can better integrate large river processes with existing conceptual frameworks in lotic ecosystem ecology.

WATER QUALITY AND BIOTA IN FOUR MULTI-STRESSOR LOTIC SYSTEMS: PATTERNS FROM A MULTI-FACETED, LARGE-SCALE, LONG-TERM DATASET

Flinders, Camille; Ragsdale, Renee; Arthurs, William ; Ikoma, Joan; Cook, Diana; Campbell, David; Messmer, Ron; Napack, Jan

101CD
Thursday, 21 May, 2015 11:15 - 23:30

Lotic systems are naturally spatially and temporally variable, and elucidating the relative response of water quality and biological endpoints to multiple stressors benefits from long-term data and multiple sampling locations within a reach. Our study used a multi-year (n=15), seasonally-sampled dataset of water quality (temperature, pH, color, conductivity, turbidity, hardness, COD, nutrients, and metals) and biota (fish, macroinvertebrates, periphyton) from multiple sites (n=5-7) in four streams (Codorus Creek, PA; Leaf River, MS; McKenzie and Willamette Rivers, OR) to examine patterns relative to non-point sources, and inputs from tributaries and wastewater discharges. Most water quality parameters were temporally variable. Greater conductivity, hardness, and color occurred downstream of effluent discharges in some streams, while tributaries were significant sources of some constituents. Bray-Curtis similarity analyses revealed that diatoms assemblages showed greater differentiation over years, while macroinvertebrates were driven largely by seasonal differences. Distinct spatial patterns in biota were observed to some streams and seasons. Analyses of biological data in the context of water quality endpoints and known stressors is underway, and detailed results will be discussed alongside challenges of multi-stressor assessments.

HYDROLOGIC PARTICIPATORY SENSING IN A DIGITAL WORLD

Fienen, Michael; Lowry, Christopher

103AB
Thursday, 21 May, 2015 11:15 - 23:30

Many observations in the hydrologic sciences are easy to obtain, requiring very little training or equipment, but large data collection efforts are hindered by personnel and telemetry costs. However, the digitally connected modern society presents new opportunities to collect real-time hydrologic data through the use of “participatory sensing” – where citizens contribute widely distributed scientific observations. Near real-time updating of datasets is possible as a direct result of the growth of mobile phone networks and high adoption rates of mobile users. We describe an example of the overall approach, including: development, methodology, barriers to entry, data uncertainty, and results of mobile phone technology. The example application characterizes groundwater and surface-water resources. The results illustrate the challenges that variability in consistency and reliability pose to the collection of high-quality data, and point to needed improvements and future developments for widespread use of low-cost techniques for hydrologic participatory sensing.

BARCODING OF TRACE DNA IN CHIRONOMID PUPAL EXUVIAE REVEALS QUALITY DIFFERENCES IN DNA EXTRACTION PROTOCOLS

Kranzfelder, Petra; Ekrem, Torbjørn; Stur, Elisabeth

103DE
Thursday, 21 May, 2015 11:15 - 23:30

Molecular tools, such as DNA barcoding, advance freshwater biomonitoring studies by allowing fast, cost-effective, and high-resolution identification for species-rich and abundant macroinvertebrates, like the Chironomidae (Diptera). Crucial for the success in the use of these tools is the performance of DNA extraction protocols. We tested six different extraction protocols on trace DNA in 570 carefully sampled chironomid pupal exuviae from two localities in Norway. Genomic DNA was isolated and the standard COI barcode sequenced successfully from 297 samples. The DNeasy® Blood & Tissue Kit produced the highest quality results (97% PCR and 34% sequences success), while the more economical QuickExtract™ solution produced results that were nearly as high (82% PCR and 35% sequence success). Out of the successfully sequenced barcodes, 14% were high-quality Chironomidae sequences matching species in the Barcode of Life Data Systems. Our results suggest that the best extraction protocols were sensitive in detecting trace amounts of DNA from multiple species present in the pupal exuviae samples, but that chironomid sequences often were masked by sequences from other taxa. Possible solutions to this will be discussed.

STATUS AND TREND OF FRESHWATER BIOLOGY IN THAILAND

Sangpradub, Narumon; Hanjavanit, Chutima

101A
Thursday, 21 May, 2015 11:15 - 23:30

Since the Earth Summit in 1992, there was the increasing interested in biodiversity in Thailand. Biodiversity and conservation is one strategy of government policy. The flora and fauna were studied in many habitats. In freshwater, algae, benthic diatom, amphibians, fishes and aquatic insects have been studied. More than 500 species of algae and benthic diatom, 500 species of zooplankton, 176 species of amphibians were recorded. Among aquatic insects, trichopteran (998 species) was the most well studied under collaboration of Thai and Austrian institutes. Ephemeropteran (54 genera), plecopteran (60 species) and heteropteran (314 species) were also got more interested than other insects. More than 50% of species list were new to science and many species remained undescribed. The developing on a biotic index of macroinvertebrates to assess water quality was successful. Molecular techniques are likely to be a useful tool to help difficulty in identification and to associate between larvae and adults of aquatic insects. Moreover, the study in ecotoxicology as biomarker for pollution will be more important in the future. Collaboration between researchers and international experts are need.

LONG-TERM VARIATIONS IN WATER QUALITY IN AN URBAN RIVER IN THE UNITED KINGDOM

Medupin, Cecilia

101B
Thursday, 21 May, 2015 11:15 - 23:30

The spatial and temporal trends of water quality of an urbanised river, River Medlock (Greater Manchester, UK) were studied in relation to point-source inputs, specifically combined sewer overflows (CSOs) and water-water treatment works (WWTWs). Water quality data for six physical and chemical parameters from three monitoring stations was collected from 2000 to 2013 by the UK's Environment Agency. A one-way ANOVA was employed to evaluate the spatial variation of water quality for each station. The results showed that there were significant spatial differences for the nitrate and phosphate and that a strong correlation between the two suggests a point source, probably the WWTWs. Conductivity and biochemical oxygen demand do not show a spatial trend to we ascribe this to the effective treatment of the organic load by the WWTWs and the absence of inputs from CSOs. Temporal analysis revealed improving water quality including a reduction in the phosphate load. This study suggests long-term spatial and temporal variations of river quality are informative for water quality decision making processes.

AD-HOC AND EX-POST DESIGNS FOR DISENTANGLING CUMULATIVE EFFECTS IN MIXED LAND USE LANDSCAPES

Yates, Adam; Armanini, David; Chambers, Patricia

101CD
Thursday, 21 May, 2015 11:30 - 11:45

A key objective of cumulative effects assessment is the prediction of the likely effects of changes in the amount and/or intensity of human activities. For this goal to be achieved the effects of individual activities must first be disentangled. In this study, we analyzed benthic macroinvertebrate data from middle-sized streams in southern Ontario exposed to urban and agricultural activities to compare study design and data analysis techniques aimed at deconstructing cumulative effects. Specifically, we look at using control/impact style designs versus ex-post variance partitioning analyses to disentangle the effects of urban and municipal wastewater inputs from agricultural inputs. Through these analyses we aimed to: 1) identify taxa, traits and metrics that can be used as indicators that are sensitive to specific effects of urban and agricultural activities; and 2) inform future assessment studies as to the effectiveness of different methods for deconstructing cumulative effects.

A NEW METHANE DATABASE AND A REVISED GLOBAL ESTIMATE OF METHANE EFFLUX FROM FLUVIAL ECOSYSTEMS

Stanley, Emily; Casson, Nora; Christel, Samuel; Crawford, John ; Gries, Corinna; Loken, Luke; Oliver, Samantha K

102C
Thursday, 21 May, 2015 11:30 - 11:45

Historical wisdom has been that CH_4 should be scarce in streams and rivers, yet it is often present at supersaturated concentrations. To better understand CH_4 dynamics and generate a global estimate of fluvial efflux, we assembled a database of 398 concentration and 222 diffusive flux measurements from >90 articles. Published values spanned >6 orders of magnitude (0-1260 uM and 10-383 mmol m^{-2} d^{-1}). Nearly all concentrations were supersaturated and only 4 sites reported negative mean fluxes. Global CH_4 emissions were estimated using (1) a simple bootstrapping approach and (2) molar ratios of CH_4:CO_2 diffusive efflux from papers that also reported CO_2 flux. These conservative calculations resulted in estimates of 35.7 ± 81.9 and 49.8 ± 131 Tg CH_4/yr- an order of magnitude greater than a prior estimate (1.5 Tg/yr). This indicates that fluvial CH_4 efflux is larger than the most recent estimates for reservoirs and ca. 20-50% of that from wetlands and lakes and respectively. While uncertainty is substantial, this suggests that streams and rivers are globally significant CH_4 sources and should no longer be excluded from global methane budgets.

PATTERNS OF STORMFLOW DISSOLVED ORGANIC MATTER CONCENTRATION, COMPOSITION, AND TIMING IN THREE SMALL URBAN STREAMS

Fork, Megan; Bernhardt, Emily; Heffernan, Jim; Urban, Dean

101B
Thursday, 21 May, 2015 11:30 - 11:45

Impervious surface cover (ISC; i.e. roads, parking lots) and subsurface connectivity via stormwater pipes increase the flashiness of streams in urban relative to undeveloped watersheds. This increased flashiness delivers pulses of dissolved organic matter (DOM) to urban streams during storms that are likely 'shunted' downstream in stormflow. Concentrations of DOM tend to be higher in urban as compared to reference streams, and urban DOM has been characterized as more labile. However, the role of subsurface connectivity via pipes versus surface connectivity of ISC is not well resolved. Here, we compare the concentration and composition of DOM in stormflow among three small urban streams in Durham, NC that have similar %ISC in their watersheds, but with nearly four-fold difference in subsurface pipe densities (ranging from 1082 to 4065 m/ha). The timing and magnitude of stormflow DOM differ among these watersheds, with more marked pulses in streams with greater pipe density. We also use EEMs and PARAFAC modeling to quantify changes in the composition of colored DOM over the course of storms and compare composition of stormflow and baseflow colored DOM.

TAKING THE ANONYMITY OUT OF RAD-SEQUENCING: LINKING THOUSANDS OF SNP MARKERS WITH THE FIRST DRAFT GENOME SEQUENCE OF THE MELTWATER STONEFLY, LEDNIA TUMANA

Hotaling, Scott; Muhlfeld, Clint C; Giersch, J. Joseph; Miller, Michael R.; Grewelle, Richard; Lu, Deborah; Jordan, Steve P.; Luikart, Gordon; Weisrock, David

103DE
Thursday, 21 May, 2015 11:30 - 11:45

Next-generation sequencing (NGS) provides the foundation upon which genome-scale data are collected for natural populations. These datasets provide the empirical framework upon which the rapidly developing field of population genomics rests. One often-cited promise of NGS-based population genetics is to further extend these data to address questions involving selection and adaptation, and provide a more functional perspective on the evolution of populations. However, to realize this promise and develop the proper links between anonymous markers (e.g., restriction-site associated DNA or RAD) and the genome from which they are sampled, a solid understanding of the genome, including its structure and gene ontology, is required. Here, we combine the collection of RAD data for the study of genetic variation across populations of Lednia tumana (Plecoptera: Nemouridae) with the first draft genome of the species. The results of this research provide not only greater context for our previously developed population-genomic markers, but also begin to provide insight into the presence of potential adaptive variation across the range of L. tumana in Glacier National Park, Montana.

ASSESSING HUMAN ALTERATIONS OF STREAM WATER CHEMISTRY FROM MODELED REFERENCE CONDITIONS

Olson, John; Hawkins, Charles

103C
Thursday, 21 May, 2015 11:30 - 11:45

One approach to assessing human impacts on streams is to compare observed conditions to those at environmentally similar streams in relatively natural condition. However, intensively managed landscapes have too few unaltered streams to establish high-quality reference conditions. We examine if empirical models predicting natural specific electrical conductivity (EC) and total phosphorus (TP) effectively estimate site-specific chemical reference conditions for areas without high-quality reference sites. We determined the models were applicable to 95% of the 1922 probabilistic survey sites sampled by the National Rivers and Streams Assessment by applying a multivariate nearest-neighbor technique. Streams outside of model experience had higher geologic sulfur (EC model) or were dryer (TP model) than calibration sites. Observed ECs were > 200 µS/cm higher than predicted natural conditions at > 30% of sites, and TP concentrations were > 50 µg/l higher than background at > 40% of sites. Modeled background conditions can provide a meaningful benchmark for assessment of stream chemistry in highly altered landscapes, and potentially could be applied to assessing thermal, hydrological, or biological conditions.

BUGS ON DRUGS: SSRIS (ANTIDEPRESSANTS) AFFECT STREAM ECOSYSTEM FUNCTION

Richmond, Erinn; Rosi-Marshall, Emma ; Lee, Sylvia; Thompson, Ross; Grace, Michael

102DE
Thursday, 21 May, 2015 11:30 - 11:45

Pharmaceuticals and personal care products (PPCPs) are emerging as a potential important pollutant in aquatic environments. One suite of anti-depressant drugs, selective serotonin reuptake inhibitors (SSRIs), are now detected in surface waters worldwide; however, the ecological impacts of SSRIs are not well understood. We conducted replicated, artificial stream experiments by exposing stream rocks naturally pre-colonized with biofilm and invertebrate communities to concentrations (20 µg/L) of fluoxetine or citalopram or a mix of both (40 µg/L). Treatments suppressed gross primary production and community respiration by at least 43%, but did not affect chlorophyll a or total algal biomass. Chironomid emergence occurred significantly earlier in all SSRI treated streams compared to the controls. In addition, individual Hydropsychidae biomass was higher in the SSRI exposed streams, suggesting that fluoxetine and citalopram may enhance developmental processes in some macroinvertebrates. Chronic exposure to fluoxetine and citalopram appears to affect aquatic biota and stream ecosystem functions. Our observations indicate that ecosystem function and invertebrate population dynamics are sensitive to PPCPs and provide an indication that these compounds may threaten stream ecosystems.

DISTRIBUTION AND GENETIC STRUCTURE OF FRESHWATER TELEOSTS IN THE KOREAN PENINSULA: INTERACTION BETWEEN HISTORICAL AND HUMAN-MEDIATED PROCESSES

Suk, Ho Young

101A
Thursday, 21 May, 2015 11:30 - 11:45

The Korean Peninsula was never completely covered by ice sheets during the multiple episodes of glaciation, and therefore served as refuge for many freshwater species. Major rivers head west and south emptying into the Yellow Sea and Korean Strait, respectively, and there are many short eastern-flowing rivers along the east coast. Western- and southern-flowing rivers have likely created confluences with the Yellow River in China, whereas eastern-flowing rivers likely had confluences with the Amur River in Russia during the climatic fluctuations of the Pleistocene epoch. The contemporary distribution and genetic structure of freshwater species may provide insight into historical signature of geodispersal processes and geographical isolation. Here, I present molecular studies exploring cryptic diversity and population structure of freshwater teleosts in the Korean Peninsula and confirming the previous claims of historical colonization events. These studies also highlighted that anthropogenic perturbation and invasion have altered the partitioning of genetic variation, upsetting the historical processes over short time-scales. Finally, I propose specific management planning at the site and species level for integrating historical and human-mediated processes.

IS THE LANDCOVER CASCADE SYSTEM-SPECIFIC? A CASE STUDY IN SAND-BED STREAMS OF THE SOUTHEASTERN US SANDHILLS ECOREGION

Sefick, Stephen; Kosnicki, Ely; Paller, Michael; Feminella, Jack

102B
Thursday, 21 May, 2015 11:30 - 11:45

The Landcover Cascade Concept (LCC), developed from high-gradient mountain streams, has not been tested in low-gradient systems, such as in coastal plains streams. We quantified LC, hydrology (Hyd), geomorphology (Geo), habitat (Hab), and macroinvertebrate functional composition (FC) in 42 SE-USA Sandhills streams, and compared 4 structural equation models with LCC using Akaike's criteria. The primary latent (derived) variable gradients were 1) LC from managed pine plantation to native longleaf pine, 2) Hyd related to increasing low and high stage duration, 3) Geo related to increasing channel enlargement, 4) Hab related to substrate size/ variation and FPOM, and 5) FC related to shredder to filterer/scraper/multivoltine taxa. The hydrology master variable model best explained influence of LC on FC (AIC weight=0.81; FC R2=52%) and thus showed the largest direct effect on biota. Further, the largest indirect effect of LC on FC was mediated by Hyd, suggesting that hydrologic variation related to LC, rather than LC directly, was most important factor linking LC to FC. Results suggest that LCC-predicted direct effects of LC on instream variables do not apply to low-gradient, sand-bed systems.

FROM SELF-HELP TO VOLUNTEER MONITORING TO CITIZEN SCIENCE – ENGAGING THE PUBLIC IN LAKE AND STREAM ASSESSMENT, RESTORATION AND PROTECTION IN WISCONSIN

Asplund, Tim; Stepenuck, Kristine; Skawinski, Paul

103AB
Thursday, 21 May, 2015 11:30 - 11:45

This presentation will discuss the ways in which citizens have effected positive change in the management and protection of Wisconsin's lakes and streams through citizen-based water monitoring networks. The Citizen Lake Monitoring Network (CLMN) and stream-focused Water Action Volunteers (WAV) began as ways to educate and promote awareness of water quality for lake shore residents, riparian land owners, students, and watershed organizations, and to help them become stewards of their waterbodies. Over time, citizens involved in these networks began to ask for and take on additional data collection responsibilities, essentially becoming volunteer monitors for state and local agencies. More recently, given the track record of proven quality assurance and an effective training and recruiting network, researchers and water managers recruit CLMN and WAV volunteers to engage in data collection efforts as diverse as documenting impacts of road salt on streams, early detection of aquatic invasive species, calibration of remotely sensed water clarity, and documenting exceedances of total phosphorus standards for the state impaired waters list. Citizens are now an integral part of Wisconsin's water management framework.

ENVIRONMENTAL CONTEXT INFLUENCES INVERTEBRATE COMMUNITY RESPONSES TO ANTHROPOGENIC PERTURBATIONS IN TEMPERATE STREAMS

Burdon, Francis; Räsänen, Katja; Jokela, Jukka; Eggen, Rik; Stamm, Christian

101CD
Thursday, 21 May, 2015 11:45 - 12:00

Assessing impacts of disturbance on stream ecosystems often uses macroinvertebrate indicators, but there is little known about the environmental factors that influence community resistance to perturbations. We predicted that community changes would be strongly contingent upon environmental context (e.g., catchment landuses) mediated through proximate effects on upstream assemblages, as opposed to the magnitude of local disturbance (e.g., wastewater discharges). To test our hypotheses, we sampled macroinvertebrate communities in twelve Swiss streams, with sampling reaches located above and below wastewater discharges, and assessed environmental factors at the local and catchment scale. We found that consistent with previous studies, wastewater discharges were associated with decreased alpha diversity and altered composition of downstream macroinvertebrate communities. Catchments with intensive landuses (e.g., cropping) had more pollution-tolerant assemblages, meaning that upstream community composition was a stronger determinant of total community sensitivity than the magnitude of the disturbance (e.g., wastewater discharges). In contrast, trait-specific indices were more sensitive to the effects of wastewater. This shows how anthropogenic influences across spatially heterogeneous landscapes shape macroinvertebrate community structure, and therefore determine the type of assemblages exposed to local disturbances

TROPICAL STREAMS AT RISK: GULLY FORMATION FROM INTENSIVE AGRICULTURE AS DRIVER OF STREAM DEGRADATION

Bezerra, Maíra; Palmer, Margaret; Filoso, Solange; Ferraz, Silvio

102B
Thursday, 21 May, 2015 11:45 - 12:00

Degradation of streams draining intensive agriculture in the humid tropics may be driven by gully formation from the combination of heavy seasonal rainfall associated with agricultural practices. However, the formation of gullies in association with intensive agriculture is rarely assessed. I investigated the impacts of intensive agriculture on gully formation in an area cultivated with sugarcane for over 60 years in Brazil. I used the slope-area criteria to evaluate the relation between existing channel heads and surveyed erosive features using form-based thresholds. Among 137 features surveyed, 98% were permanent and ephemeral gullies; 94% occurred below the threshold line of existing channel heads, suggesting that gullies are being formed in regions unfavorable for gully formation. The presence of gullies in recent stage of formation (i.e., ephemeral gullies, 36% of 137) suggests that sugarcane management enhances gully formation. By exacerbating gullying, intensive agriculture may impair streams as they become more hydrologically connected to their uplands, and excess water and sediments is delivered to stream ecosystems.

DIETARY AND TAXONOMIC VARIATION IN UTILIZATION OF MICROBIAL CARBON AND PHOSPHORUS BY DETRITIVOROUS CADDISFLIES

Halvorson, Halvor; White, Grant; Scott, Thad; Evans-White, Michelle

102DE
Thursday, 21 May, 2015 11:45 - 12:00

Heterotrophic microbes are critical for nutrition of detritivorous animals, yet few studies have examined drivers of variation in utilization of microbial nutrients by detritivores. Here, we assessed the potential for diet leaf type and nutrient content as well as detritivore species identity to control detritivore utilization of microbial carbon (C) and phosphorus (P). We fed oak and maple litter conditioned under 50 or 500 µgP/L to the detritivorous caddisfly larvae Ironoquia spp., Lepidostoma spp., and Pycnopsyche lepida and used the radioisotopes 14-C and 33-P to trace dietary microbial C and P. Leaf type did not affect utilization efficiency of microbial C or P, however caddisflies had reduced P utilization efficiency on diets of greater P content, indicating alleviation of P-limited growth. Two caddisflies of lower body C:P exhibited higher utilization efficiencies of microbial C and P than the species of higher body C:P, possibly because the former two species required proportionally greater microbial C and P to support fast growth of P-rich tissues. Our findings support a link between stoichiometric constraints and utilization of microbial nutrients by detritivorous animals.

NITROUS OXIDE YIELDS FROM URBAN STORMWATER PONDS IN 8 US CITIES

Blaszczak, Joanna; Steele, Meredith; Hobbie, Sarah; Badgley, Brian; Heffernan, Jim; Bernhardt, Emily; Groffman, Peter

101B
Thursday, 21 May, 2015 11:45 - 12:00

Stormwater ponds are being created and modified throughout US cities with unclear biogeochemical consequences. The high temperatures, low oxygen and high nitrate typical of these urban water bodies should provide ideal conditions for denitrifying microbial communities, and as a result stormwater ponds may be major sources of both N2O and N2 fluxes within urban landscapes. During the summer of 2014, we collected sediments and measured potential N2O and N2 production from 4 highly urban and 4 ‘green space’ ponds within 8 USA metropolitan statistical areas (MSAs). We found tremendous variation in N2O and N2 potential production rates both within and across cities, with N2O rates ranging from 0.002 to 37.6 µg N2O g-1 hr-1 and N2 rates ranging from 0 to 44.2 µg N2 g-1 hr-1. N2O accounted for as little as 0.01% to as much as 99% of total gaseous N fluxes. There were no consistent differences in N fluxes between high density and green space ponds. Instead, we found that microbial biomass was the single best predictor of total gaseous N fluxes (R2=0.19; p<0.001).

HIGH AUTOCHTHONOUS SUPPORT OF AQUATIC INVERTEBRATES DESPITE EXTREMELY LOW RATES OF GROSS PRIMARY PRODUCTION IN BOREAL STREAMS

Hotchkiss, Erin; Landström, Emelie; Sponseller, Ryan; Karlsson, Jan

102C
Thursday, 21 May, 2015 11:45 - 12:00

Terrestrial support of aquatic food webs is pervasive, with terrestrial subsidies responsible for significant fractions of biomass production and widespread heterotrophy (ecosystem respiration > gross primary production; ER>GPP) in freshwater ecosystems. Despite this, aquatic GPP may disproportionately fuel consumer production and respiration relative to the quantity of terrestrial organic carbon (OC) potentially available for consumption. We used diet and consumer d2H to quantify the relative contributions of autochthonous (algal) and terrestrial OC to invertebrates from five boreal streams draining different catchment areas and compositions. We compared consumer autochthony with OC concentrations and fluxes, including stream metabolism (GPP, ER). Invertebrate autochthony ranged from 11-100% in a second-order stream despite low GPP (<0.5 gCm-2d-1), high dissolved OC (18-45 mg/L), and pronounced net heterotrophy (GPP:ER = 0.04). Using taxa-specific biomass and stable isotopes sampled from June-October, we will calculate site-specific relative autochthony for further comparison with in-stream OC sources and fluxes. Invertebrates appear to preferentially consume autochthonous OC in streams with low GPP and high terrestrial OC, suggesting a crucial, but often overlooked role for in-stream primary production in boreal stream food webs.

POTENTIAL BENEFITS OF CONSERVATION STRATEGIES FOR STREAM BIODIVERSITY IN AN AGRICULTURAL LANDSCAPE

Keitzer, Steven; Ludsin, Stu; Sowa, Scott; Sasson, Anthony; Herbert, Matthew; Annis, Gust; Froelich, August; Volmer-Sanders, Carrie; Arnold, Jeff; White, Mike; Yen, Haw; Daggupati, Prasad; Norfleet, Lee; Johnson, Mari-Vaughn; Atwood, Jay; Rewa, Charlie

103C
Thursday, 21 May, 2015 11:45 - 12:00

The implementation of best management practices offers great potential for improving the environmental sustainability of agriculture. However, potential tradeoffs associated with their implementation (e.g., agricultural production costs versus environmental benefits) remain poorly understood at spatial scales relevant for management. Herein, we examine potential biodiversity benefits of conservation strategies (e.g., reduction of a single stressor vs. multiple stressors) for streams in the largest agricultural watershed in the Laurentian Great Lakes region, the Western Lake Erie Basin (WLEB). Our findings show that 68% and 90% of the streams in the WLEB exceed eutrophication thresholds for phosphorus and nitrogen, respectively, and nearly half of these streams surpass recommended levels for suspended sediments. Our findings also show that stream biotic integrity has been compromised in many parts of the WLEB. Although these threats and impacts are diffuse, using a novel modeling approach that is broadly applicable to any watershed, we are able to identify specific watersheds and streams within the WLEB to focus conservation efforts. This information is vital for developing effective strategies that improve the environmental sustainability of agriculture.

DEVELOPMENT OF MACROINVERTEBRATE INDEX OF BIOTIC INTEGRITY (M-IBI) FOR LARGE RIVER BIOASSESSMENT: A PILOT WORK IN SONGHUA RIVER, CHINA

Li, Li; Wang, Yeyao; Liu, Tingliang; Liu, Lusan

101A
Thursday, 21 May, 2015 11:45 - 12:00

The index of biotic integrity (IBI) is the most widely used multi-metric index to assess the ecosystem health. However, development of IBI for large river lags far behind that for wadeble streams and has been mainly focused on fish assemblages. We developed a macroinvertebrate index and assessed the relative condition of Songhua River, the third largest river in China. In 2012 and 2013, the survey was conducted twice (May and September) per year at 33 raftable sites on the mainstream and tributaries of Songhua River. Macroinvertebrates were sampled with a standardized level of effort with artificial substrate, and water chemistry and habitat data were collected at the same time. Of 35 potential metrics considered, 6 core metrics were finally chosen: EPT taxa richness, percent sensitive taxa, percent Facultative taxa, Hilsenhoff Biotic Index (HBI), ASPT and Marglef index. According to the results, the macroinvertebrate index of biotic integrity (M-IBI) was both sensitive to differences in water pollution index and habitat score. For the entire dataset, the least-impacted sites had significantly higher mean scores than the other site classifications.

UNDERSTANDING IMPACTS OF VOLUNTEER WATER MONITORING PROGRAMS ON NATURAL RESOURCE POLICY AND MANAGEMENT

Stepenuck, Kristine

103AB
Thursday, 21 May, 2015		11:45 - 12:00

Volunteer water monitoring coordinators from 345 programs in the United States were surveyed to learn about the types and breadth of impacts these programs have had on natural resources policy and management. Eighty-six percent of coordinators responded. A wide variety of impacts on water bodies, policies and organizations were reported at the local, state and federal levels. Multiple regression models were used to identify program characteristics that were significantly related to reported impacts. This presentation will describe the current population of volunteer water monitoring programs in the United States, the program characteristics found to be significantly related to achieving natural resources policy and management outcomes, and examples of reported outcomes.

DISENTANGLING MULTIPLE STRESSOR EFFECTS ON INVERTEBRATE ASSEMBLAGES OF BOREAL STREAMS

Johnson, Richard; Angeler, David; McKie, Brendan; Sandin, Leonard; Hallstan, Simon

101CD
Thursday, 21 May, 2015 13:30 - 13:45

Catchment land use and other human activities interact to affect the biodiversity of stream ecosystems. Understanding how different stressors individually or in concert affect aquatic communities is needed for river basin management. The North Baltic water district, the most populated area in Sweden (ca 2.9 million inhabitants), was selected as a model system to study the cumulative effects of different stressors on benthic assemblages of streams. A total of 88 streams sampled for benthic invertebrates and water chemistry, and classified according to land use and hydrogeomorphological variables, were included in the study. Agricultural land use was the main pressure, resulting in elevated nutrient levels (mean 48 ± 43 µg TP/L, max 205; mean 428 ± 431 µg NO3-N/L, max 2332), loss of connectivity (61% or 54 sites classified as poor or bad) and alterations in morphology (44% or 39 sites). The response of benthic invertebrate diversity and selected species traits along increasing gradients of exposure to single and combined stressors will be discussed.

PLANNING FOR DILUTED BITUMEN SPILLS ON FRESH WATER

Silliman, Benjamin

102B
Thursday, 21 May, 2015 13:30 - 13:45

In 2007, 400 barrels of diluted bitumen spilled into the Burrard Inlet at Vancouver Harbor. None of the spilled product was recorded to have submerged. In 2010, 20,082 barrels of diluted bitumen spilled into the Kalamazoo River. Large quantities of the spilled product submerged and response costs neared $1 billion. The variance in fate and behavior of the oil sands products in these two spills highlights new challenges for response crews working on fresh water. New techniques for response planning are necessary for improved response efforts. The fate of diluted bitumen is largely dependent on the environmental characteristics of the spill location. Rough sedimentation, high turbidity, strong sunlight exposure, high temperatures, and strong currents can weather diluted bitumen and increase its overall density. Determining these characteristics can help responders predict the time frame that bitumen may submerge. To explore possible techniques, the environmental characteristics of the Great Lakes were determined with remote sensing and the data was applied to a risk factor identifying areas with the greatest risk of diluted bitumen submergence in the event of a spill.

IMPACTS OF FLOW REGULATION ON DISTRIBUTION, BEHAVIOR, AND PHYSIOLOGY OF NEOPORUS SP. (COLEOPTERA: DYTISCIDAE), A COMMON INHABITANT OF SOUTHEASTERN FLOODPLAINS

Holt, Courtney; Batzer, Darold

103DE
Thursday, 21 May, 2015 13:30 - 13:45

Lack of regular flood events on regulated rivers can have wide-ranging effects on the distribution of floodplain inhabitants. This study aims to determine the effects of flow regulation on the predaceous diving beetle Neoporus sp., a widespread southeastern U.S. floodplain inhabitant. Floodplains of three regulated and three unregulated river systems were investigated over a three-year period to determine differences among the systems regarding Neoporus (1) distribution across the floodplains, (2) propensity for flight (dispersal), and (3) lipid and protein stores. The data show distinct differences between the rivers: Neoporus populations were restricted to permanent waters on the regulated floodplains, while on the unregulated floodplains they regularly accessed temporary waters ($p<0.001$). Behaviorally, populations in regulated systems were significantly less likely to disperse via flight ($p<0.001$). Physiologically, individuals in regulated systems contained significantly lower concentrations of lipids than those in unregulated systems ($p=0.03$). Protein concentrations did not differ. These results suggest that a lack of regular flood events has significantly affected multiple aspects of Neoporus populations in regulated systems. Thus, Neoporus may be a useful indicator of overall floodplain connectivity.

EFFECTS OF DISTURBANCES ON UPSTREAM AND DOWNSTREAM MOVEMENTS: WHEN AND WHERE ARE DROUGHTS LIKELY TO HAVE THE MOST IMPACT ON NEOTROPICAL HEADWATER STREAMS?

Covich, Alan; Crowl, Todd; Perez-Reyes, Omar

101B

Thursday, 21 May, 2015 13:30 - 13:45

Most Caribbean headwater streams are non-seasonal and base flows persist throughout the year. However, regional climate models predict prolonged droughts are likely to be more common in the future. Our long-term data since 1990 demonstrate that dry periods affect the abundance and spatial distributions of freshwater shrimps. In general, these migratory species are positively rheotactic and move into the direction of flow. However, distributions of large river shrimp (Macrobrachium spp.) are typically limited to deeper, downstream pools. In contrast to expectations, high concentrations of Macrobrachium in the lower pools apparently caused behavioral shifts resulting in upstream movement to the highest headwater pools for two years following 1994, the driest year of record. Determining changes in the directions and distances of movement could serve as an indicator of drought intensity and duration for regional comparisons among tropical rainforest streams. With projected increases in droughts it is important to understand which physical and biotic variables trigger shifts in the patterns of movement that might alter sustainability of these ecologically and economically significant populations.

SPATIAL PATTERNS OF GPP AND R IN A BOREAL STREAM NETWORK

Baker, Christina; Jones, Jeremy; Harms, Tamara

102C
Thursday, 21 May, 2015 13:30 - 13:45

Patterns of primary production (GPP) and respiration (ER) in stream networks will depend, in part, on patterns of availability of limiting resources. Resource competition theory suggests that resource ratios determine competitive advantage between two species. This theory has been extended to competition between freshwater heterotrophs and autotrophs, though competition is altered by light availability. In the boreal forest, stream DOC and nutrient concentrations are linked with permafrost distribution. Watersheds with extensive permafrost have higher DOC and lower inorganic nitrogen concentrations than watersheds with little permafrost. We evaluated patterns in metabolism across a boreal forest stream network in relation to light, DOC, and nutrient availability to assess what factors best describe patterns of GPP and ER. We measured whole-stream metabolism in nine stream reaches draining watersheds that varied in permafrost extent. We predict that competition between heterotrophs and autotrophs will be dependent on light and DOC availability. It is important that we understand patterns of metabolism in boreal stream networks, because changes in light and DOC availability are likely to occur with climate induced changes in fire regimes and permafrost thaw.

THE CHRONOLOGIC RECORD OF BURROWING MAYFLIES (HEXAGENIA SPP.) IN SAGINAW BAY, LAKE HURON

Schloesser, Don

102DE
Thursday, 21 May, 2015 13:30 - 13:45

Return of burrowing mayflies has been identified as a management goal in lake rehabilitation plans in the Great Lakes since the 1980s. However, we do not know where mayflies were endemic and therefore, whether their use as a management goal is logical in specific areas. We constructed a chronologic record (1770-2001) of mayflies from mayfly tusks in sediments and historic records to determine that mayflies: were low in abundance between 1770 and 1800, indicating nymphs were endemic in the bay; increased and remained abundant between 1815 and 1959, in response to increased nutrients from watershed development; and, abundance declines 1959, as a result of nymph extirpation caused by eutrophication and resulting anoxia. Between 1991 and 2008, limited sampling and visual observations indicate mayflies had not yet begun to recolonize Saginaw Bay.

UNDERWATER AND ON THE BEACHES: CITIZEN SCIENCE EFFORTS SUPPORTING AQUATIC SCIENCES RESEARCH AT SLEEPING BEAR DUNES NATIONAL LAKESHORE

Tyner, Emily; Ray, Dan; Jennings, Sue ; Moraska Lafrancois, Brenda

103AB
Thursday, 21 May, 2015 13:30 - 13:45

Since 2009, citizen science volunteers have provided invaluable data collection at Sleeping Bear Dunes National Lakeshore (SLBE). Volunteers regularly monitor 11 permanent beach transects documenting sick and dead birds by date/species/location and assessing Cladophora algae and invasive mussel biomass. Dozens of volunteers have contributed over 4,500 hours to ongoing research. Collected data has been used by park managers for decision making and by research scientists, as part of a coordinated effort to better understand these die-off events. Building off the success of the beach monitoring program, a partnership was formed between the National Parks Conservation Association (NPCA), SLBE, and the University of Wisconsin-Milwaukee to further engage the public in coastal monitoring and explore the possibility of citizen diver involvement in Lake Michigan research. In 2014, the framework for an underwater citizen science program using divers was developed, tapping into substantial local interest in aquatic environmental issues among a pool of highly skilled divers. Seven divers went through training in underwater data collection and scientific dive skills. Next steps include technical training in scientific technique and securing long-term project funding.

COLONIZATION SPEED AND PATTERN OF BENTHIC MACROINVERTEBRATE COMMUNITIES DURING THE EARLY SUCCESSIONAL PHASES IN TEMPERATE ASIA

KIM, Dong Gun; Bae, Yeon Jae

101A
Thursday, 21 May, 2015 13:30 - 13:45

We quantified the colonization speed and pattern of benthic macroinvertebrate communities in 2 created small-sized wetlands (non-planted and planted) and a nearby older man-made wetland in the experimental station of Korea University in the central Korean Peninsula from May 2009 to October 2010. The colonization speed was evaluated using the newly adopted colonization index (CI) and the colonization pattern was analyzed using multivariate analysis (NMS). As predicted, the CI (range 100–0) decreased over time in the created wetlands; this decrease was more rapid in the planted wetland than in the non-planted wetland. After 400 Julian days, the benthic macroinvertebrate community in the planted wetland showed 90% similarity with that in the older man-made wetland. The NMS results revealed that the colonization pattern of benthic macroinvertebrates differed significantly according to vegetation (non-planted versus planted [$p = 0.000$]), season ($p = 0.001$), and year ($p = 0.014$). These results suggest that, initial planting in wetland can accelerate succession of benthic macroinvertebrate communities and colonization index was more easily evaluated colonization speed and stabilization of benthinc macroinvertebrate communities.

EXTREME STREAM–ECOSYSTEM EFFECTS FROM RIPARIAN DISTURBANCE IN AN OTHERWISE INTACT WATERSHED

Dodds, Walter; Larson, Danelle; Veach, Allison

103C
Thursday, 21 May, 2015 13:30 - 13:45

Whole-watershed vegetation removal generally causes large alterations to stream hydrological and nutrient dynamics. Published experiments suggest riparian corridor preservation during watershed removals may mitigate impacts because the zones serve as a buffer between streams and terrestrial areas. Yet, the relative contribution of riparian zones to sediment and nutrient transport in an impacted watershed is largely unknown; ecosystem shifts could be only a response to riparian removal. We removed woody, riparian vegetation in a grassland stream watershed subject to streamside woody expansion. We measured stream physiochemical parameters (e.g., nutrients and sediments) before and after the removal in the impacted riparian watershed and a neighboring control watershed and used Before-After, Control-Impact analyses to test for treatment effects. Riparian wood removal led to ten-fold increases in mean stream water nitrate, total phosphorus and sediments for three years following disturbance. Our data suggested that riparian zones exert a disproportionate influence on streams relative to their small area in the watershed. Maintaining the native condition of riparian zones may be desirable over mechanical restoration to achieve native state given their extreme sensitivity to disturbance.

LONG-TERM EFFECTS OF DISEASE-DRIVEN AMPHIBIAN DECLINES ON MACROINVERTEBRATE COMMUNITIES IN TROPICAL STREAMS

Rantala, Heidi; Rugenski, Amanda; Barnum, Thomas; Colon-Gaud, Checo; Múrria, Cesc; Whiles, Matt

101B
Thursday, 21 May, 2015 13:45 - 14:00

Disease-driven amphibian declines in neotropical headwater streams have affected ecosystem functioning and macroinvertebrate community structure. We examined changes in macroinvertebrate communities associated with amphibian declines in 10 Panamanian headwater streams that provided a chronosequence of pre- and post-decline conditions. Total macroinvertebrate taxa richness declined with time since amphibian declines across all streams ($P<0.05$, $r2=0.31$), and declines appeared mostly related to non-consumptive effects of tadpoles. Macroinvertebrate community analyses from two sites indicate that communities are becoming more similar 5 years after declines compared to pre-decline conditions (ANOSIM, $P<0.05$).Consistent post-decline changes in macroinvertebrate communities included decreases in the biomass of shredders, filter-feeders, and the total community but increased biomass of collector-gatherers. Taxonomic changes included Farrodes replacing Thraulodes as the abundant scraping mayfly, and shifts in predator taxonomic composition. Though the mechanisms underlying these responses are not clear, we hypothesize that dietary plasticity as related to shifts in basal resources associated with tadpole grazing and bioturbation had a crucial role in structuring the post-decline invertebrate community.

TRENDS IN THE DISTRIBUTION AND ABUNDANCE OF HEXAGENIA SPP. IN SAGINAW BAY, LAKE HURON, 1954-2012: MOVING TOWARDS RECOVERY?

Siersma, Heather

102DE
Thursday, 21 May, 2015 13:45 - 14:00

Multiple anthropogenic disturbances to the Great Lakes have been linked to extirpation of the environmentally sensitive burrowing mayfly genus, Hexagenia, from Saginaw Bay, Lake Huron c1960. Following recent reports of proximate adult swarms, we surveyed Saginaw Bay to assess its nymphal Hexagenia population - an indicator of benthic health. We corroborated adult presence at three Tawas City, Michigan area locations in 2010 at densities of >17 adults/m2. Further, we found 1.5 nymphs/m2 from Ponar grab samples collected at 57 bay sites between 2009 and 2012 with nymphal presence at 15.8% of those sites. Additionally, we related sampling site abiotic conditions to nymphal presence using Zero-Inflated Poisson regression; model results indicate the probability of nymphal absence is positively correlated with sediment sandiness. Comparing current to prior bay sediment composition revealed that >75% of bay sediment contained >50% sand in 2012, up from about half of bay sediment c1975. While documentation of nearby adults and in-bay nymphs may indicate Hexagenia are recovering in Saginaw Bay, modeling results suggest that the observed increases in sediment sandiness may limit potential Hexagenia recovery.

RESPONSE OF AUTOTROPHIC AND HETEROTROPHIC PATHWAYS TO NUTRIENTS ALONG STREAM NETWORKS

Rosemond, Amy D. ; Helton, Ashley M. ; Bumpers, Phillip M. ; Benstead, Jonathan P.

103C
Thursday, 21 May, 2015 13:45 - 14:00

Nutrient pollution stimulates algal carbon, but reduces retention/availability of terrestrially derived particulate organic carbon (POC). Algae and POC serve as food for animals and substrates for nutrient uptake throughout stream networks. We examined where carbon gain or loss may result across river networks due to nutrient pollution using the Little Tennessee River (LTR) network. We paired published relationships between stream network position and POC standing stocks and annual gross primary production with published POC loss and algal gain responses to nutrient enrichment to estimate potential for carbon loss or gain for each 10-m reach in the LTR. Net carbon losses were predicted in 1st-4th order streams, while net carbon gains were predicted in 5th-7th order streams. Human modification of landscapes is sometimes limited to higher-order streams, but can also impact headwaters. Our analysis is a first approximation of these dynamics and does not include serial processing and transport, but illustrates that terrestrially derived POC, essential for functions downstream of its source, can be reduced relative to algal gain in large parts of river networks

WATER ACTION VOLUNTEERS (WAV) - TOTAL PHOSPHORUS MONITORING IN WISCONSIN'S STREAMS

Albright, Lindsey; Stepenuck, Kristine

103AB
Thursday, 21 May, 2015 13:45 - 14:00

Phosphorus is an essential nutrient responsible for plant growth, but it is also the most widespread water pollutant in Wisconsin lakes. Runoff from farm fields and other disturbed lands flow into streams, elevating phosphorus levels that can cause adverse conditions in surface water bodies. In 2010, Wisconsin developed numeric criteria for in-stream phosphorus levels and began monitoring streams across the state to collect the necessary data to develop impaired waters lists. Beginning in 2012, the Wisconsin Department of Natural Resources (WDNR) and the University of Wisconsin-Extension (UWEX) engaged Water Action Volunteers (WAV) stream monitors to collect total phosphorus samples at monitoring sites selected by the WDNR and the volunteers. The success rate from 2012-2014 was 99.8%, with monitoring occurring at almost 200 sites statewide. In 2014 alone, WAV volunteers contributed $40,000 worth of time. Several local groups also obtained grants to support monitoring at local sites with savings amounting to over $25,000 in monitoring and shipping costs. Given the success of this program, total phosphorus monitoring by WAV volunteers will continue to help WDNR meet future monitoring and assessment needs.

ABIOTIC VARIABLES CONTROL STREAM METABOLISM IN A NUTRIENT LIMITED MONTANE RIVER NETWORK

Mejia, Francine ; Bellmore, J. Ryan; Benjamin, Joseph; Zuckerman, Adrianne; Watson, Grace; Newsom, Michael; Fremier, Alexander

102C
Thursday, 21 May, 2015 13:45 - 14:00

Stream metabolism (GPP and ER) is an integrated measure of ecosystem function that takes into account allochthonous and autochtonous sources. Understanding the drivers and the spatial and temporal variability of available energy is critical for developing watershed restoration strategies that take advantage of hot spots and peak times of GPP and ER. We measured metabolism in 13 reaches continuously for one year at representative sites across a montane river network in Washington, USA. We hypothesized that 1) abiotic factors (nutrients, light, temperature, flow and geomorphology) rather than biotic factors (grazing, spawning, riparian inputs) are a first order control on GPP and ER, and 2) most reaches are heterotrophic through most of the year. Results were consistent with our hypothesis. Light, temperature, and flow were main drivers for both GPP and ER, nitrogen was important for GPP and geomorphology for ER. Conversely, most sites were heterotrophic except in April and July coinciding with leafing, longer photoperiod and warmer temperatures. Findings are relevant because they explore spatial and temporal variation in metabolism at the watershed scale.

ENERGY FLOWS AND SUBSIDIES ACROSS AQUATIC-TERRESTRIAL BOUNDARIES OF TEMPORARY PONDS VIA AMPHIBIAN MIGRATIONS

Fritz, Kelley; Kirschman, Lucas; Whiles, Matt

103DE
Thursday, 21 May, 2015 13:45 - 14:00

Subsidies of materials and energy across aquatic-terrestrial boundaries are recognized in systems ranging from oceanic islands to freshwater wetlands. Such subsidies are important for recipient habitats and can alter consumer distribution and increase consumer growth, abundance, and biomass. Temporary ponds can be closely linked to surrounding forests via forest-to-pond and pond-to-forest subsidies, including amphibian egg deposition and metamorph emergence, respectively. We intensively sampled amphibian assemblages in eight temporary ponds in Southern IL to quantify energy flow associated with egg deposition and metamorph emergence of each species breeding in the ponds. Fluxes in and out of ponds were highly variable. For example, spotted salamanders (Ambystoma maculatum) transported between 1.9-71.3 g AFDM from the surrounding forest into ponds via egg deposition, while metamorph emergence exported 0-147.5 g AFDM from ponds. A. maculatum energy exports from ponds exceeded inputs for three ponds and inputs exceeded exports for the remaining ponds. We used these estimates to produce a total amphibian energy budget for each pond. Understanding the roles of amphibians in linking habitats is increasingly important in light of ongoing population declines and losses.

CUMULATIVE EFFECTS OF DEVELOPMENT ON NEAR-SHORE BENTHIC MACROINVERTEBRATE COMMUNITIES OF SOUTHERN PRECAMBRIAN SHIELD LAKES

Jones, Chris

101CD
Thursday, 21 May, 2015 13:45 - 14:00

The Muskoka River Watershed (Ontario, Canada) was selected by the Canadian Water Network, as a case-study region for the development of a "cumulative effects monitoring framework". Biomonitoring was identified as a critical part of this framework because it provides biologically relevant (i.e., effects-based) indicators of cumulative effects. Two questions about biological effects were posed: Do benthic community assembly patterns exist in minimally disturbed lakes and streams in the Muskoka River Watershed? Has development altered these assembly patterns? A dataset of catchment attributes (e.g., physiography, land-use), local habitat, water quality, and the taxonomic structure of benthic communities was compiled for 120 lakes and 120 streams. Redundancy analysis (RDA) and variance components analysis were used to describe patterns of community assembly. Results provided evidence about the cumulative effects of cottage development, road building, urbanization, agriculture, and other development-related land-use changes on lakes and streams.

ASSESSMENT OF WATER QUALITY PATTERNS IN 7 CANADIAN RIVERS IN RELATION TO STAGES IN OIL SANDS INDUSTRIAL DEVELOPMENT, 1972 TO 2010

Chambers, Patricia; Alexander, Alexa

102B
Thursday, 21 May, 2015 13:45 - 14:00

To evaluate changes in water quality in relation to type and stage of oil sands mining activities in northern Alberta, Canada, we compiled a 38 year dataset (1972 to 2010) and used it to examine patterns in concentrations and loads of 14 water quality parameters (dissolved Se, As and B; total U, V, Mn, Ca and Zn; total suspended solids; dissolved and total organic C; conductivity; bicarbonate) along 7 tributaries of the Athabasca and Clearwater rivers. Both type (open pit versus in situ drilling) and stage (pre-development, early land clearing and construction, and expanded development) of development affected water chemistry. Concentrations of 8 parameters and loads of 10 parameters were greater ($P<0.05$) post development compared to reference values. Loads for 10 parameters were also greatest ($P<0.05$) during early exploration and land clearing compared to reference and subsequent expanded operations. Our results indicate that erosion and subsequent runoff associated with land clearing and early operational activities in the oil sands region have affected water quality, and highlight the need for continued systematic real-time monitoring of these systems.

RESPONSE OF FUNCTIONAL TRAITS AND DIVERSITY OF TROPICAL STREAM MACROINVERTEBRATES TO ENVIRONMENTAL VARIABLES IN XISHUANBANNA WATERSHED, YUNNAN CHINA

Wang, Beixin; Ding, Ning; Yang, Weifang

101A
Thursday, 21 May, 2015 13:45 - 14:00

We used 29 categories in 8 qualitative traits and 7 functional diversity indices of tropical stream macroinvertebrates to explore community response to environmental variables in Xishuanbanna (XSBN), upper Mekong River Basin, China. A total of 16 environmental variables and most traits categories were significantly different ($p<0.05$) between reference sites (RS, n=19) and disturbed sites (DS, n=40). RLQ and fourth-corner combined analysis showed that 7 traits except habit trait were predictable along an integrative disturbance gradient mainly resulted from % farmland, %urban, TN and %sands. Functional richness (FRic), trait richness (TR) and trait diversity (TD) were significantly different between RS and DS. Moreover, FRic and TR could be predicted by a subset of local environmental variables. In addition, contributions of pure environmental variables to FRic, TD and TR were significantly high, while contributions of pure spatial vectors were very low. We also found no significant relationships between trait patterns and spatial vectors. Our results supported the habitat-templet theory of biological traits, and suggested that traits, FRic and TR were potential and complementary indicators of stream condition in Mekong River Basin.

EFFECTS OF PETROLEUM BUNKERING ACTIVITIES ON THE SOCIO-CULTURAL AND ECO-ECONOMICS OF MAJIDUN RIVER, IKORODU, NIGERIA

OWODEINDE, FATAI GBOLAHAN; NDIMELE, PRINCE EMEKA

102B
Thursday, 21 May, 2015 14:00 - 14:15

Crude oil bunkery is huge problem in Nigeria accounting for a loss of about 10% of total crude export in Nigeria. The occurrence of heavy metals (often associated with crude oil spillage) in water, sediments and a commercially important fish (Clarias gariepinus) from petroleum bunkering sites in Majidun River, Ikorodu, Nigeria were studied in order to assess the impacts of this illegal activity on humans using socio-cultural and eco-economic variables. The study was conducted over a period of 12 months (Jan, 2014 – December, 2014). The data showed high levels of metals (Cu, Zn, Fe, Cd, Pb and Mn) in different compartments of the ecosystem. Metal levels were all above the tolerable limits recommended by regulatory bodies (FAO and WHO). It was discovered that income generated by local fishers has reduced because of petroleum and heavy metal pollution. The study also revealed a drastic reduction in the delivery of such ecosystem services like food, water, socio-cultural festivities etc. Government intervention by enactment/enforcement of existing laws on crude oil bunkering is important to conserve biodiversity, prevent food insecurity and safe lives.

EMERGING AMPHIBIANS AS A POTENTIAL SOURCE OF ESSENTIAL FATTY ACIDS FOR RIPARIAN PREDATORS

Vega, Shelby; Fritz, Kelley; Kirschman, Lucas; Whiles, Matt; Trushenski, Jesse

103DE
Thursday, 21 May, 2015 14:00 - 14:15

Ecological subsidies, transfers of energy and materials between habitats, can affect food web dynamics in recipient ecosystems. Aquatic-terrestrial subsidies have received a fair amount of attention due to the seemingly distinct boundaries between these habitats. We investigated the transport of essential polyunsaturated fatty acids (PUFA) across the aquatic-terrestrial boundary via amphibian emergences. We hypothesized that consumption of emergent amphibians by ground-dwelling spiders is an important pathway for PUFA transfers to terrestrial habitats. Three Wolf Spider species (Tigrosa georgicola, Schizocosa crassipes, Schizocosa saltatrix) were collected from temporary pond margin (“pond”) and adjacent upland habitats (“upland”). Lipids were extracted and analyzed to determine total lipid content and fatty acid profile. There was a significant difference in n-3 fatty acid content between pond and upland T. georgicola individuals (ANOSIM p=0.035), suggesting that spiders in riparian habitats are consuming more aquatic prey. Results suggest this type of aquatic-terrestrial transfer may represent an important pathway for PUFA subsidies to riparian food webs.

EIGHT-YEAR SEASONAL TIME SERIES OF KLAMATH RIVER METABOLISM

Genzoli, Laurel; Hall, Robert O.

102C
Thursday, 21 May, 2015 14:00 - 14:15

Gross primary production (GPP) and ecosystem respiration (ER) control dissolved oxygen in rivers and they describe resource availability at the base of the foodweb. Long-term studies of patterns and controls on GPP and ER in rivers are limited. We calculated daily ecosystem metabolism on the Lower Klamath River from 2007–2014 during the May–November water-quality monitoring season, resulting in approximately 1,150 daily measurements of GPP and ER. Daily GPP predicted ER across the dataset (r2=0.42), with the strength of the relationship varying among years. During base-flow periods, daily GPP ranged from 3–20 g O2 m-2 d-1, but at higher flows GPP decreased with increasing discharge, with ER following similar patterns. Seasonal mean GPP and ER were not related to annual discharge metrics, despite inclusion of extreme high- and low-flow years in our study. Mean July–August GPP ranged from 8–17 g O2 m-2 d-1. Summer GPP decreased after year-3 of our study, following decreases in total phosphorus and total nitrogen concentrations. While discharge likely controls within year variation in GPP and ER, base-flow variation may be driven by nutrients.

THE VALUE OF COLLABORATION: USING PUBLIC MUSEUMS TO LINK THE COMMUNITY WITH RESEARCH

Burdett, Ayesha

103AB
Thursday, 21 May, 2015 14:00 - 14:15

In recent years, public engagement in science has been a topic of discussion for the informal science education (ISE) community. The New Mexico Museum of Natural History and Science (NMMNHS) is an example of an ISE institution that engages the general public with exhibits, lectures and science experiences. Many ISE institutions share an underlying goal of improving understanding of science and encouraging an enthusiasm for the natural world. To increase the capability of NMMNHS to support public participation in biological research, we are building collaborations with university and agency partners. These collaborations can be used as an informative model for other institutions wanting to create opportunities for the general public. ISE institutions can complement scientific researchers by providing expert staff (including educators and trained volunteers), and by making research accessible to a general audience.

CONNECTING SEASONAL RIPARIAN BUFFER METRICS AND NITROGEN CONCENTRATIONS IN A PULSE-DRIVEN AGRICULTURAL SYSTEM

Christensen, Jay; Nash, Maliha; Compton, Jana; Wigington, Jr., Parker J.; Griffith, Stephen

103C
Thursday, 21 May, 2015 14:00 - 14:15

Riparian buffers have been well studied as best management practices for nutrient reduction at field scales yet their effectiveness for bettering water quality at watershed scales has been difficult to determine. Seasonal dynamics of the stream network are often overlooked when evaluating the use of riparian buffers in water quality management. In the Willamette Valley, OR, seasonal precipitation results in surface flows within agricultural fields that carry pulses of nutrients past riparian buffers and into streams and rivers. We present seasonal spatially-explicit metrics and statistically relate them to seasonal nitrogen concentrations. Field data, LiDAR data and soils data are used to estimate seasonal stream extents for the Calapooia River Watershed, OR. Flow-weighted metrics of buffered agriculture are calculated and we attempt to use statistical models that use information theory and model averaging to provide seasonal watershed estimations of nitrogen removal and losses through riparian buffers in the watershed. Findings from the seasonal statistical analysis will be presented and their implications for water quality and buffer management will be discussed.

INDIVIDUAL AND CUMULATIVE EFFECTS OF FINE SEDIMENT, NUTRIENT ENRICHMENT, AND INSECTICIDE POLLUTION ON STREAM MICROCOSMS

Chara-Serna, Ana; Richardson, John

101CD
Thursday, 21 May, 2015 14:00 - 14:15

Sedimentation, nutrient enrichment, and insecticide pollution are some of the most pervasive stream ecosystem stressors associated with agriculture. However, despite their common co-occurrence, there is little empirical information about their cumulative impacts on stream communities. We manipulated fine sediment, nutrient, and insecticide (Chlorpyrifos) levels in laboratory stream microcosms to evaluate their individual, pairwise, and three-way effects on aquatic invertebrates, benthic algae biomass, and leaf litter decomposition. Two levels of each stressor (natural, high) were randomly applied to 32 microcosms in a fully crossed factorial design with eight treatments and four replicates. We hypothesized pairwise and three-way stressor combinations would have mostly additive effects and few synergistic and antagonistic interactions. Our results indicate sedimentation was the most detrimental ecosystem stressor, with significant negative effects on leaf litter decomposition and other response variables. Insecticide pollution was the second most pervasive stressor, with important negative effects on invertebrate community and leaf litter decomposition. In agreement with our hypothesis, ecosystem responses to multiple stressor treatments mainly suggested additive interactions.

BENTHIC HABITAT CONDITIONS AND THE POTENTIAL FOR RE-COLONIZATION BY HEXAGENIA MAYFLIES IN GREEN BAY, LAKE MICHIGAN

Groff, Christopher; Kaster, Jerry

102DE
Thursday, 21 May, 2015 14:00 - 14:15

The lower Green Bay, Lake Michigan ecosystem is expected to be in a state of recovery from past degradation; however, mayflies of the genus Hexagenia, a well-known bioindicator of water quality, were extirpated in the 1950s and have yet to make a return. Several experiments are in progress, including raising Hexagenia nymphs collected from the Mississippi River in aquaria containing sediment collected from Green Bay, and incubating Hexagenia eggs in field enclosures. This study seeks, based on experimental results gathered, as well as analysis of sediment composition, macroinvertebrate community metrics, and dissolved oxygen concentrations across the bay, to determine Hexagenia's potential for re-introduction and re-colonization. These large insects serve important ecological roles associated with bioturbation and providing a high-quality food base for foraging fish. Their renewed presence in Green Bay would likely prove beneficial for higher trophic levels and the enhancement of fisheries, as well as an important indication of the bay's improving habitat quality.

USING BENTHIC COMMUNITIES TO DETECT THE SHIFT OF HUMAN-NATURAL PARADIGM IN JIUJZHAIGOU NATIONAL PARK, CHINA

Wang, Lizhu; Pan, Yangdong; Cao, Yong; Wang, Quanxi; Wang, Beixin; Zhang, Jie; Pang, Wanting; Deng, Guiping

101A
Thursday, 21 May, 2015 14:00 - 14:15

Understanding the structure, function, and process of natural ecosystems and how human activities have modified the characteristics of such ecosystems is essential for sustaining ecoservices and ecosystem function. Benthic communities are important components and commonly used indicators for detecting changes in aquatic ecosystem. The Jiuzhaigou National Park ecosystem has experienced a series of deforestation, progressive conservation measures, increasing tourist pressure, environmentally sound park management, and climate change since 1960s. The footprint of such human-natural paradigm shifts resulted by such historical events can be reflected by long- and short-term changes in benthic communities. We linked benthic community compositions from lake sediment core, and headwater-downstream sequential surveys with nearby human activities and upland ecosystem characteristics in conjunction with lake and river in situ nutrient enrichment experiments to detect the shift in human-natural paradigm of Jiuzhaigou National Park. Our preliminary results indicate that the high demand of ecoservices, intensive management practice, and climate change have strong linkages with characteristics of the ecosystem as indicated by the benthic communities. Our results have strong implication for the park management policy making and practice operation.

LOW RESILIENCE OF TROPICAL RIVER BIOTA TO EXPERIMENTAL DECREASE IN GLACIER RUNOFF

Cauvy-Fraunié, Sophie

101B
Thursday, 21 May, 2015 14:00 - 14:15

Worldwide climate-driven changes in glacier runoff regimes have important consequences on the hydrological cycle and on the remarkable aquatic biodiversity of alpine valleys. Yet we still lack an in-depth mechanistic understanding of glacier retreat impacts on aquatic biota and evaluation of biological resilience. We addressed this issue through a 4 year-experimental glacier runoff manipulation in a tropical aquatic food web. Flow reduction altered benthic algae and fauna community composition in less than a couple of weeks but it took the system c.a. 14-16 months to return to its initial ecological state after perturbation ceased. Lower water flow abruptly modified food web organization by enhancing both algal and herbivore biomass, pushing the system to alternate trophic states, in line with predictions of ecological state theory. This research provides the first experimental evidence of the profound effects increased glacier runoff variability can have on alpine rivers structure and functioning: alterations in species composition will lead to alternate ecosystem states with limited capacities to rebound. It highlights that predictions of aquatic diversity with respect to climate change must emphasize indirect trophic interaction effects.

THE ROLE OF STRATIFICATION ON THE APPARENT TROPHIC POSITION OF COPEPODS IN LAKE MICHIGAN AS REVEALED BY THE NITROGEN STABLE ISOTOPE

Driscoll, Zac; Bootsma, Harvey

102DE
Thursday, 21 May, 2015 14:15 - 14:30

Due to the difficulty of sampling during winter months, information on full seasonal dynamics of zooplankton in the Great Lakes is limited. To examine seasonal trends in zooplankton feeding within Lake Michigan we monitored nitrogen stable isotope composition for three copepod species and seston between the months of January and September. Over the winter, the 15N:14N ratios for all three copepod species were high relative to seston, with values similar to those observed for lake trout in Lake Michigan. Following thermal stratification the 15N:14N ratios for all three species and seston dropped substantially. We suggest that this overall seasonal trend could be related to a switch in nitrogen source at the base of the food. The large hypolimnetic calanoid ,Limnocalanus macrurus, maintained a 15N:14N ratio higher than that of the other two copepod species measured. We hypothesize that differences between copepod species reflect difference in preferred feeding depths, which are distinguishable due to vertical differences in seston nitrogen isotope ratios within the water column.

CHANGES OF MACROINVERTEBRATE ASSEMBLAGES ACROSS LAKES AND STREAM SITES IN RELATION TO NATURAL ENVIRONMENT AND TOURISM PRESSURE IN JIUJZHAIGOU NATIONAL PARK, CHINA

Cao, Yong; Wang, Beixin; Zhang, Jie; Wang, Lizhu; Pan, Yangdong; Wang, Quanxi; Deng, Guiping

101A
Thursday, 21 May, 2015 14:15 - 14:30

Freshwater ecosystems in China are widely and severely stressed by water-quality pollutions, over-harvesting, and habitat losses. Among water bodies in the least-disturbed conditions are those streams and lakes in national parks, such as Jiuzhaigou National Park in Sichuan Province. However, with a rapid-growing economy and tourisms, even many of these parks are increasingly vulnerable to human impacts, including eutrophication and siltation. In the present study, we investigated the changes of macroinvertebrate assemblages in Jiuzhaigou National Park in relation to natural habitat characteristics, water quality, and tourism pressure by sampling 9 lakes and streams reaches above and below each of these lakes in summers 2013-14. All benthic individuals were sorted and identified. Light-trap samples were used to supplement the benthic samples. We found some substantial differences among the lakes and stream reaches in taxa richness, % EPT, and overall taxonomic composition. These differences were related to both natural environmental variables and a tourism pressure index. Our findings should be useful to develop a biological indicator for the stream system and guide future management practice.

THE EFFECTS OF CHANGING VEGETATION STRUCTURE AND WETLAND HYDROLOGY ON AQUATIC COMMUNITIES IN FIRE-SUPPRESSED WETLANDS OF THE SOUTHEASTERN UNITED STATES

Chandler, Houston; Gorman, Thomas; Haas, Carola

103DE
Thursday, 21 May, 2015 14:15 - 14:30

In the southeastern United States, ephemeral wetlands are commonly embedded within pine flatwoods, but a history of fire suppression and exclusion has altered the natural disturbance regime of these wetlands. Wetlands excluded from frequent fire are characterized by a shift in vegetation structure, which occurs through development of a woody mid-story and decline of herbaceous plants. We monitored 21 ephemeral wetlands in northwest Florida that contained a range of vegetation and hydrologic characteristics, and in each wetland we sampled the amphibian and aquatic invertebrate communities. We found that amphibian community composition was similar across a range of wetland vegetation characteristics, but varied over a range of wetland hydroperiods. We created multiple linear regression models that assessed the influence of wetland vegetation and hydrology on the relative abundance of three invertebrate groups. The best-approximating models indicated that relative abundance of each aquatic invertebrate group responded differently to vegetation and hydrology. Our results demonstrate that fire suppression and exclusion can lead to a shift in aquatic community composition in pine flatwoods wetlands.

COMPUTATIONAL CONSIDERATIONS OF WHOLE STREAM METABOLISM

Song, Chao; Ballantyne, Ford

102C
Thursday, 21 May, 2015 14:15 - 14:30

Modeling whole stream metabolism based on diel dissolved oxygen (DO) cycle involves estimating multiple parameters in an ordinary differential equation. This often poses statistical and computational challenges. Numerical approximation, especially the simple Euler method, is often employed in solving differential equation in stream ecology literatures. In addition, DO, light and temperature are measured on a discrete basis. We often have to make interpolation between measurement time when estimating metabolism. However, the error and uncertainty associated with such approximation and interpolation has seldom been explicitly evaluated. Here, we use representative datasets to demonstrate how much difference the approximation and interpolation lead to in parameter estimates. Our analysis demonstrates that numeric approximation in solving differential equation could lead to major difference in stream metabolism estimates, especially with long measurement interval. Different interpolations of light and temperature also resulted in difference in metabolism estimates but to a less extend. We conclude that it is important to always use accurate numeric solution to differential equation in metabolism estimates.

HOW DO CHANGES IN CONSERVATION ALTER HOT-SPOTS OF NUTRIENT EXPORT IN AGRICULTURAL WATERSHEDS?

Hanrahan, Brittany; Tank, Jennifer L.; Christopher, Sheila F.

103C
Thursday, 21 May, 2015 14:15 - 14:30

Our project is quantifying whether the watershed-scale planting of winter cover crops (e.g., ryegrass) after corn/soybean harvest reduces export of excess fertilizer nutrients from agricultural fields into subsurface tile drains. In the 3000-acre Shatto Ditch Watershed (Kosciusko Co, IN), we collected water samples every 14d from 25 tile drains and 10 longitudinally-distributed stream sites along 8km of the Shatto to quantify the effects of cover crops on tile drain and stream export of nitrate-N. High-frequency sampling revealed that tile drains are year-round sources of nitrate-N to streams, and ~60% of tiles flow even in dry seasons (e.g., Summer/Fall, mean=13.9 mgNO3-/L) while >85% of tiles flow in Winter/Spring when nitrate concentrations are higher (mean=17.1 mgNO3-N/L). Additionally, tile concentrations vary spatially highlighting the importance of field-specific management practices (e.g., fertilizer application). Planting cover crops decreased average tile nitrate-N concentrations by 36% in Winter/Spring, which represented a 45% reduction in N-flux from tiles compared to pre-cover crop planting. After one year of planting, cover crops significantly reduced nutrient export from agricultural fields, showing promise for improving water quality in freshwaters in agricultural landscapes.

IDENTIFYING CRAYFISH METABOLIC PATHWAYS DIAGNOSTIC OF NUTRIENT AND DISSOLVED OXYGEN STRESS

Izral, Natalie; Brua, Robert; Culp, Joseph; Chambers, Patricia; Yates, Adam

101CD
Thursday, 21 May, 2015 14:15 - 14:30

Pulse discharges are difficult to capture with community or population based bioindicators; thus, there is a need for effective, fast responding indicators at the molecular level. In this study, we investigated the suitability of the crayfish metabolome as a bioindicator of nutrient or dissolved oxygen (DO) stress by identifying altered metabolic pathways and metabolites. Forty-eight captive Procambarus clarkii were randomly assigned one of six nutrient (high, normal, low) and DO (high, normal, low) treatment groups. After four days of acclimation, crayfish were individually housed in 1.4 L aquariums for a 14 day exposure period. After the exposure period, crayfish were sacrificed, and hepatopancreas, gill, and tail muscle tissues were dissected and immediately frozen in liquid nitrogen. A Bruker Avance 600 MHz spectrometer was used to acquire 1D 1H NMR spectral data. Through multivariate data analysis of the metabolomic spectral data, we expect to identify distinguishable metabolic pathways and metabolites among crayfish subjected to varying nutrient and DO concentrations. The crayfish metabolome may be classified as a holistic, fast responding, and early warning indicator of adverse nutrient and DO concentrations.

THE FUTURE OF PUBLIC PARTICIPATION IN FRESHWATER RESEARCH: OPPORTUNITIES AND CHALLENGES

Latimore, Jo A.; Burdett, Ayesha

103AB
Thursday, 21 May, 2015 14:15 - 14:30

The growing field of public participation in scientific research (PPSR) includes citizen science, volunteer monitoring, and other forms of organized research in which members of the public engage in the process of scientific investigations: asking questions, collecting data, and interpreting and applying results. PPSR can help freshwater scientists deal with common challenges, including access to field sites, availability of long-term and spatially broad data sets, connecting research to societal needs, and building public and political support for research and management. The public also benefits, by gaining access to technical and scientific expertise that can support local efforts to protect and manage aquatic systems. While these benefits are substantial, PPSR is not without challenges. Recruitment, training, and retention of members of the public can require a significant investment of resources. Furthermore, the quality of data collected by non-scientists is often questioned by other scientists, funders, and decision makers. We will review how the projects highlighted in this Special Session have incorporated these benefits and challenges, followed by open discussion among participants and speakers on the future of PPSR for freshwater science.

MODELING THE TRANSPORT OF OIL-PARTICLE AGGREGATES FROM A DILUTED BITUMEN SPILL IN KALAMAZOO RIVER, MICHIGAN

Zhu, Zhenduo; Waterman, David; Garcia, Marcelo

102B
Thursday, 21 May, 2015 14:15 - 14:30

The July 2010 spill of diluted bitumen into the Kalamazoo River was the largest release of heavy crude into an inland waterway in U.S. history. Since the spill, extensive cleanup and recovery efforts have taken place, including dredging of oiled sediment in 2013-14. The spilled oil mixed with river sediment and formed negatively buoyant oil-particle aggregates (OPA). The spill required new science for containment and recovery of submerged oil including modeling the fate and transport of OPAs. Multiple hydrodynamic models were implemented for the 60-km oil affected reach of the Kalamazoo River, including a 3D model for Morrow Lake and 2D models for several sediment traps. A Lagrangian particle tracking model was developed and coupled with the hydrodynamic model in order to simulate the transport, deposition, and resuspension of OPAs. An April 2013 high flow scenario and a July 2013 low flow scenario were selected for simulation and analysis. Results of the hydrodynamics and particle-tracking models will be presented; the numerical techniques and governing equations of the particle tracking model will be discussed.

ECOLOGY AND MANAGEMENT OF NEOTROPICAL RIVERS: LESSONS FROM THE CLOUD FOREST IN ECUADOR

Snyder, Eric; Kynak, Tim; Krynak, Katherine; Lyons, Jane

101B
Thursday, 21 May, 2015 14:15 - 14:30

We explored functional feeding group associations in five cloud forest streams located in the Reserva las Gralarias at mid-elevation on the Western front of the Andes Mountains, Mindo, Ecuador. Aquatic insect guilds were consistent with patterns reported elsewhere (high predator/prey ratio, heterotrophic, and dependence on upstream processing and supply of FPOM). We also found that there was a predictable shift in FFG ratios from 1st through 4th order. Specifically, an increasing dependence on autotrophic production, decrease in predator representation, and increase in benthic POM. No significant impact of upstream grazing was detected, and ongoing research seeks to understand reciprocal subsidies and food web dynamics between streams and endemic glass frogs (F. Centrolenidae) using stable isotope analyses. This project is part of an ongoing biennial study-abroad class and is a useful tool for evaluating potential grazing impacts by establishing and tracking baseline conditions.

THE USE OF MACROINVERTEBRATES IN BIOMONITORING OF FRESHWATER HABITATS IN MESOAMERICA AND THE CARIBBEAN

Springer, Monika

101B
Thursday, 21 May, 2015 14:30 - 14:45

Biomonitoring for water quality and environmental studies began only recently in the majority of Latin American countries, and efforts have been undertaken in order to establish the use of freshwater macroinvertebrates as biological indicators. In the Mesoamerican region, from Mexico to Panama, and in the Caribbean, several countries have developed their own indices (e.g. Cuba, Costa Rica, El Salvador), or are in the process of adopting one (e.g. Panama, Puerto Rico). These are mainly biotic indices at the family level, such as the Hilsenhoff Family Biotic Index, adapted for El Salvador, and the BMWP-index (Biological Monitoring Working Party index, first established for England), which was adapted for Costa Rica and Cuba, in 2007 and 2005, respectively. In Costa Rica, the awareness about the usefulness of macroinvertebrate assemblages as indicators of water quality, along with concern about the high degree of contamination in many rivers in the country, has led to their being included in an executive decree. This unique regulation governs the evaluation and classification of the quality of surface water bodies and establishes the BMWP-CR index for biological monitoring.

BIRTH, LIFE, AND DORMANCY OF AN EPHEMERAL FOOD WEB

O'Neill, Brian; Thorp, James

103DE
Thursday, 21 May, 2015 14:30 - 14:45

Community assembly provides insights into trophic level interactions through space and time. However, studies rarely span sufficient time periods. We use playa wetlands to explore if traditional community assembly applies to ephemeral ecosystems. We tracked invertebrate diversity and abundance through multiple hydroperiods in six playa wetlands. We used stable isotope techniques to investigate trophic structure (size, variation, and redundancy). Playa wetland communities generally increased in diversity and abundance early, then declined. Community structure was reflective more of temporal changes, whereas food chain length and food web complexity were associated with community membership (overall taxa, insect, and predator richness). Food web redundancy was positively associated with total invertebrate density and biomass. Community assembly in playas proceeds differently depending upon which species are active. While community density and diversity did increase early, the community decline could be due to a combination of many factors. Food web structure patterns could be due to the specific traits and behaviors of individual immigrating and emigrating organisms. The instability of ephemeral ecosystems means we need to incorporate the disconnection of temporal scales into assembly theory.

CAN WE CAN SOLVE COASTAL "DEAD ZONES" FROM A DISTANCE? WATERSHED-SCALE CONSERVATION REDUCES NUTRIENT EXPORT FROM AGRICULTURAL LANDSCAPES

Tank, Jennifer L.; Hanrahan, Brittany; Christopher, Sheila F.

103C
Thursday, 21 May, 2015 14:30 - 14:45

Excess fertilizer nutrients entering Midwestern agricultural streams degrade both local and downstream water quality, resulting in algal blooms and subsequent hypoxic "dead zones" far from the source. We are quantifying the benefits of watershed-scale conservation practices that may reduce nutrient runoff. Specifically, research is lacking on whether the watershed-scale planting of winter cover crops can reduce stream nutrient inputs. After a pre-treatment year of data collection, we planted cover crops on ~70% of croppable land (=1610 acres) in the Shatto Ditch Watershed (IN), quantifying nutrient loss from fields by sampling subsurface tile drains and the adjacent stream every 14d. Cover crops improved stream water quality by reducing excess nutrients exported downstream; dissolved N and P concentrations and fluxes were significantly lower in tiles draining fields with cover crops compared to those without. Annual watershed nitrate-N export decreased by 31%, from 91 to 67 kgN/day, translating to an additional 10,500kg of N retained annually on the landscape for crops. Finally, successful outcomes highlighted through watershed-scale demonstration projects can facilitate widespread adoption, making them powerful agents of change for advancing conservation success.

TO CONSTRAIN OR NOT TO CONSTRAIN: FORCING METABOLISM PARAMETERS TO ECOLOGICALLY FEASIBLE VALUES

Lottig, Noah

102C
Thursday, 21 May, 2015 14:30 - 14:45

Gross primary production (GPP) and ecosystem respiration are fundamental ecosystem attributes. Significant advancement in sensor technologies has provided opportunities to estimate these parameters in aquatic ecosystems using high-frequency dissolved oxygen data. However, in low productivity systems, metabolism models generate daily parameter values that are not ecologically realistic (e.g., negative GPP). Analysis of metabolism data from Trout Lake, an oligotrophic study lake of the North Temperate Lakes Long-Term Ecological Research Program in northern Wisconsin, indicates that unrealistic model predictions occur on 40-60% of the days.. We compared model estimates of primary production generated from oxygen data with those measured concurrently using the traditional 14C approach to assess whether constraining model metabolism parameters to realistic values or filtering dissolved oxygen data to remove noise improved metabolism estimates. We found that both pre-filtering the data to remove noise and constraining the parameters to realistic values increased the strength of relationships between metabolism estimates based dissolved oxygen and those based on 14C.

A GEOMORPHIC FRAMEWORK AND TOOLBOX FOR SUBMERGED OIL VOLUME QUANTIFICATION, KALAMAZOO RIVER, MICHIGAN

Zelt, Ronald; Fitzpatrick, Faith A.; Graan, Thomas; Cozzarelli, Isabelle; Johnson, Rex

102B
Thursday, 21 May, 2015 14:30 - 14:45

In July 2010, the largest inland oil spill from a ruptured pipeline released more than 20,000 barrels of diluted bitumen to the Kalamazoo River, Michigan. Spilled oil interacted with river sediment and then submerged, requiring the development and implementation of new approaches for detection and recovery of oil mixed with sediment. A fluvial geomorphic framework and methods aided detection and mapping of submerged oil and oiled sediment along 60 km of the spill-affected Kalamazoo River. Differentiating spilled oil from legacy hydrocarbons in riverbed sediment also was needed. As cleanup of residual submerged oil continued into 2014, an oil volume quantification technique was developed that integrated use of physical, chemical, forensic, and statistical tools. Quantity and distribution of submerged oil can identify and prioritize river segments for remediation. Aspects of oil quantification analysis, considerations for accuracy, and lessons learned are presented. The geomorphic framework and toolbox were successful approaches for the Kalamazoo River submerged oil quantification, applicable to other inland spills of heavy oils. Final submerged oil quantification results have not yet been released by U.S. EPA.

MOLECULAR PHYLOGEOGRAPHIC STUDIES OF FRESHWATER BENTHOS IN EAST ASIA, WITH SPECIAL REFERENCE TO THE COMPLEX FORMATION HISTORY OF THE JAPANESE ARCHIPELAGO

Tojo, Koji

101A
Thursday, 21 May, 2015 14:30 - 14:45

Japan consists of four main and a number of smaller islands. The majority of which are “Continental-Islands”, that separated from the Eastern margin of the Eurasian Continent. The remainder being “Oceanic Islands”. In general, biodiversity on the continental islands is not so high, and as such it is often referred to as a “Satellite Shop” of the continent. In the Japanese Archipelago however, an extremely high degree of biodiversity has been achieved and maintained. Because, this archipelago maintains its condition as a comparatively naturally wet environment due to its Asian monsoon climate, and it stretches across multiple biomes in its north-south orientation. Moreover, the complex geohistory of this archipelago has contributed greatly to the degree of biodiversity observable. In particular, as a result of the weak vagility of freshwater benthos, they have very strongly reflected the effects of these geohistorical factors in their population and genetic structures. Therefore, the benthos inhabiting streams feature as suitable study targets for discussion of phylogeography. In this presentation, I would like to introduce these features by taking examples from several concrete case studies.

IMPACTS OF THERMAL AND FLOW ALTERATION ON BENTHIC STREAM MACROINVERTEBRATES DOWNSTREAM OF WATER SUPPLY RESERVOIRS

Yarra, Allyson; Richards, Todd; Roy, Allison

102DE
Thursday, 21 May, 2015 14:30 - 14:45

The effects of temperature and flows on benthic macroinvertebrates have been documented; however, the combined effect of thermal and flow alteration caused by impoundments is less studied. We assessed the impact of thermal and hydrologic regimes on macroinvertebrates in 14 Massachusetts streams: six impounded by water supply reservoirs, two impounded by unmanaged reservoirs, and six unimpounded control streams. Transducers installed in 2012 and 2013 have continuously measured temperature and pressure every 15 minutes. We sampled benthic macroinvertebrates in riffle habitats in each stream in May 2014 and identified taxa to family or genus. Average abundances of tolerant taxa in the families Chironomidae and Simuliidae were higher in streams below water supply reservoirs than in control streams. In contrast, richness of sensitive EPT taxa was greater in control streams (16.7 ± 2.6) than downstream of water supply reservoirs (12.8 ± 2.9). Our results suggest that water supply reservoirs alter macroinvertebrate assemblages. Analyses examining linkages between thermal and hydrologic metrics and macroinvertebrates will be used to determine potential mechanisms of impairment and identify management approaches to minimize impoundment impacts to stream ecosystems.

THE FUTURE OF PUBLIC PARTICIPATION IN FRESHWATER RESEARCH: OPPORTUNITIES AND CHALLENGES

Latimore, Jo A.; Burdett, Ayesha

103AB
Thursday, 21 May, 2015 14:30 - 14:45

The growing field of public participation in scientific research (PPSR) includes citizen science, volunteer monitoring, and other forms of organized research in which members of the public engage in the process of scientific investigations: asking questions, collecting data, and interpreting and applying results. PPSR can help freshwater scientists deal with common challenges, including access to field sites, availability of long-term and spatially broad data sets, connecting research to societal needs, and building public and political support for research and management. The public also benefits, by gaining access to technical and scientific expertise that can support local efforts to protect and manage aquatic systems. While these benefits are substantial, PPSR is not without challenges. Recruitment, training, and retention of members of the public can require a significant investment of resources. Furthermore, the quality of data collected by non-scientists is often questioned by other scientists, funders, and decision makers. We will review how the projects highlighted in this Special Session have incorporated these benefits and challenges, followed by open discussion among participants and speakers on the future of PPSR for freshwater science.

THE FUTURE OF ECOLOGICAL CAUSAL ASSESSMENT

Norton, Susan

101CD
Thursday, 21 May, 2015 14:30 - 14:45

When biological monitoring detects degraded biological conditions, causal assessments guide management actions toward factors responsible for the condition. Over the past 20 years, the U.S. EPA has developed methods to help investigators identify causes. The next generation of causal assessment methods will leverage the increased volumes of environmental monitoring data: more stressors at more locations; better temporal resolution from continuous monitors; and more types of biota detected by e-DNA. These data provide the opportunity to improve and streamline causal assessment by developing field-based exposure-response relationships for common stressors and combinations of stressors; matching degraded sites with environmentally similar non-degraded sites; and developing spatial models to better define naturally occurring parameters. These advancements likely will increase the chances of restoring degraded waters because there will be greater confidence in the science, causal explanations, and choice of management actions. DISCLAIMER: The views expressed in this presentation are those of the author and do not necessarily reflect the views or policies of the U.S. EPA

SUMMARY OF THE DECONSTRUCTING CUMULATIVE EFFECTS SPECIAL SESSION: WHERE TO FROM HERE?

Bailey, John

101CD
Thursday, 21 May, 2015 14:45 - 15:00

Aquatic bioassessment programmes are typically aimed at the detection and evaluation of the effects of single industrial activities such as mining, agriculture, urban development, hydroelectric development and logging. One of these activities alone can introduce a variety of stressors into the aquatic environment, often in combinations characterised by complex stressor interactions that can make assessment and attribution of adverse effects on these systems challenging. This Special Session brought together researchers from around the globe who have taken on various aspects of this challenge. This paper will summarise the findings of the Special Session presenters, identify common themes among them and knowledge gaps they that they recommend for future research initiatives. Finally, there will be a brief exploration of the continuing challenges cumulative effects pose for researchers and resource managers, particularly with a changing climate.

MONITORING STREAM BIO-INTEGRITY USING MACROINVERTEBRATES IN A HIGH INTENSITY COFFEE-GROWING REGION: CONTRASTING AN INDEX BASED APPROACH WITH REFERENCE SITE COMPARISONS IN THE PIRRIS WATERSHED, COSTA RICA

de Jesus Crespo, Rebeca; Pringle, Catherine

101B
Thursday, 21 May, 2015 14:45 - 15:00

Coffee farming is an important land use type in tropical highlands, yet there are few studies addressing its impact on aquatic communities. The goal of this study was to provide descriptive baseline data to fill this information gap. We monitored benthic macroinvertebrate families for one year on 17 sub-watersheds dominated by intense coffee farming within Costa Rica's Pirris watershed. We followed 1) an index based approach, using biotic integrity indices, and 2) a reference site approach by comparing a sub-set of our sites (N=5) with a forested sub-watershed. The index-based approach classified most of our sites as "good" suggesting that coffee farming has moderate impact on bio-integrity. On the other hand, the reference site comparison showed a different assemblage of macroinvertebrate families in coffee streams relative to the forested site, with a steep decline in the proportion of shredders in the coffee streams. Our results suggest that intense coffee farming may lead to changes in the functional structure of local streams, and that that this change is not detected by following an index-based approach to assess biotic integrity.

THE VALUE OF WATER QUALITY IMPROVEMENTS ACHIEVED WITH AGRICULTURAL BEST MANAGEMENT PRACTICES

Roley, Sarah S.; Tank, Jennifer L.; Tyndall, John C.; Witter, Jonathan D.

103C
Thursday, 21 May, 2015 14:45 - 15:00

Excess nitrogen (N) is a concern for freshwaters, and it is particularly problematic in agricultural regions. One conservation strategy for removing excess N from agricultural run-off is the implementation of best management practices (BMPs). Despite their prevalence, cost information is lacking for many BMPs, which can be a barrier to implementation by farmers, and can also inhibit effective management planning by federal and state agencies that provide cost-share funds as incentives. In this analysis, we consider three N-removal BMPs: wetlands, two-stage ditches, and cover crops. For each, we estimate 1) direct costs of implementation; 2) costs to USDA conservation programs; and 3) cost-effectiveness, in $/kgN removed. Finally, we compare implementation cost with water quality benefits. Wetlands were generally the most cost-effective BMP. Over long time periods (50 years), two-stage ditches were the second-most cost-effective, and cover crops were the least cost-effective. In contrast, over 10 years, cover crops ranked second, and two-stage ditches were least cost-effective. Nevertheless, for all three BMPs, water quality benefits exceeded costs, suggesting that BMP implementation can be a cost-effective method for managing excess N.

AQUATIC MACROINVERTEBRATE METACOMMUNITY STRUCTURE IN FORESTED WETLANDS OF WEST-CENTRAL WISCONSIN

Church, James; Little, Amanda

103DE
Thursday, 21 May, 2015 14:45 - 15:00

Factors regulating faunal community assembly in isolated habitat patches have long been of interest to community ecologists. Interspecific relationships, environmental characteristics, and dispersal among patches all play a role in community assembly; however the influence of these factors may vary considerably across taxonomic membership. Metacommunity theory integrates local ecological processes such as species sorting on community assembly along with landscape-level processes such as dispersal. There is a need to assess this theory and expand upon it. This study investigates aquatic macroinvertebrate community structure across 55 wetland communities. We sampled invertebrate community structure in 39 ephemeral and 16 permanent wetland communities in west-central Wisconsin using D-nets and surface-associated activity traps three times from May until July. We investigated how functional feeding group, taxonomic diversity, community structure, and organisms' life-history characteristics are related to environmental characteristics and spatial connectivity among isolated wetlands. Results indicate differential responses to time of sampling, environmental characteristics and spatial relationships among these taxonomic groups.

IMPACTS OF A MAJOR DILUTED BITUMEN (OIL SANDS) SPILL INTO THE KALAMAZOO RIVER (MICHIGAN) ON BENTHIC INVERTEBRATES

Desotelle, Micaleila; Hamilton, Stephen K.

102B
Thursday, 21 May, 2015 14:45 - 15:00

North America's largest inland oil spill and the first major oil sands spill in a freshwater environment occurred in 2010 in the Kalamazoo River (Michigan). We summarize what is known about the impacts on benthic invertebrates, drawing on our own sampling as well as data collected by state and federal agencies. We used artificial substrata to assess densities of macroinvertebrates in the same sites as a rapid assessment by the Michigan Department of Natural Resources. Both studies found that macroinvertebrate densities were reduced with some recovery the following year. We conducted in situ bioassays with juvenile Hyalella azteca in 2011. Survival did not differ among sites, but growth rates of juvenile H. azteca did decrease downstream of the pipeline break. We collected crayfish to measure bioaccumulation of heavy metals. Impacts on mussels and fish will also be discussed. Recovery from the spill appears to have occurred quickly, and these results are comparable to other oil spills. Long term impacts are uncertain as little research has been conducted on submerged oil.

HABITAT USE BY DIFFERENT MITOCHONDRIAL LINEAGES OF THE ATYID SHRIMP PARATYA AUSTRALIENSIS IN STREAMS OF MELBOURNE, AUSTRALIA

Lovell, Anthony

102DE
Thursday, 21 May, 2015 14:45 - 15:00

The atyid shrimp Paratya australiensis is a complex of closely related genetic lineages, of which 5 occur across Melbourne. Previous studies examining habitat use by P. australiensis have not considered variation between lineages. We examined habitat use and associations with conspecific lineages, for 3 demographic classes of 2 lineages of P. australiensis. We found strong associations with increasing levels of macrophyte cover for both lineages across demographic classes and both lineages were positively associated with conspecific lineages. Finding that both target lineages are strongly associated with increasing macrophyte cover indicates, regardless of genetic diversity, macrophyte cover is universally important to P. australiensis. The occurrence of different lineages in the same patches could indicate reproductive isolation between lineages or alternatively that secondary contact between them has occurred relatively recently. If foreign lineages of P. australiensis were introduced into a stream where another lineage occurs – and they were not reproductively isolated – they are likely to inhabit the same habitat patches, thereby increasing the potential of hybridisation and ultimately the extinction of the local lineage.

BIOGEOGRAPHY OF THE ISONYCHIID MAYFLY ISONYCHIA JAPONICA WITH A WIDE DISTRIBUTION IN EAST ASIA, INFERRED FROM MOLECULAR PHYLOGENETIC ANALYSES (EPHEMEROPTERA, ISONYCHIIDAE)

Tojo, Koji; Saito, Rie

101A
Thursday, 21 May, 2015 14:45 - 15:00

The isonychiid mayfly Isonychia japonica is distributed widely across the East Asian region. Especially in Japan, they are distributed widely inhabiting a wide range of habitats, including both the upstream and downstream areas, i.e., I. japonica is typically considered a “Habitat-Generalist” species. In this study, genetic analyses of the mtDNA COI, 16S rRNA regions and the nDNA ITS2, histone H3 regions were performed, using samples of this species collected widely from areas Japan, and also using several samples from the Korean Peninsula and the Russian Far East. As a result of this study, it was revealed that I. japonica is composed of two major and significantly genetically differentiated clades; Continental vs Japan’s clades. Furthermore, it was also revealed that the Japan’s clade is composed of two sub-clades; clade J-U vs J-D. It was revealed that the specimens consisting clades J-U and J-D were each predominantly taken from upstream and downstream areas, respectively. These results suggested that this “Generalist” species have acquired a broad distribution accompanied by a variety of genetic differentiation factors by means of a complex geological history.

AQUATIC MACROINVERTEBRATE METACOMMUNITY STRUCTURE IN FORESTED WETLANDS OF WEST-CENTRAL WISCONSIN

Church, James; Little, Amanda

103DE
Thursday, 21 May, 2015 15:00 - 15:15

Factors regulating faunal community assembly in isolated habitat patches have long been of interest to community ecologists. Interspecific relationships, environmental characteristics, and dispersal among patches all play a role in community assembly; however the influence of these factors may vary considerably across taxonomic membership. Metacommunity theory integrates local ecological processes such as species sorting on community assembly along with landscape-level processes such as dispersal. There is a need to assess this theory and expand upon it. This study investigates aquatic macroinvertebrate community structure across 55 wetland communities. We sampled invertebrate community structure in 39 ephemeral and 16 permanent wetland communities in west-central Wisconsin using D-nets and surface-associated activity traps three times from May until July. We investigated how functional feeding group, taxonomic diversity, community structure, and organisms' life-history characteristics are related to environmental characteristics and spatial connectivity among isolated wetlands. Results indicate differential responses to time of sampling, environmental characteristics and spatial relationships among these taxonomic groups.

OUR COMMON FRESHWATER FUTURE

Bogatov, Viktor; Vshivkova, Tatyana; Khristoforova, Nadezhda

101A
Thursday, 21 May, 2015 15:00 - 15:15

Rivers and lakes are not limited by borders, but share their wealth with all living things on Earth. Saving freshwater for future generations is the important task of our time. To do this we must create a common strategy with unified regulations and take them as general international instruments for the introduction of water management policy in Asia. The first step toward this goal will be developing international freshwater bioassessment protocols with explicit procedures of design, sampling, data analysis. Second, implementing these developments at the level of ministries and creating an Asian Water Commission. Other tasks include establishing Freshwater Ecology Training Centers at top Asian universities; sharing information, professionals and students; preparing common bilingual identification keys and textbooks; listing indicator organisms with tolerance values; and establishing an Asian Water Data Bank. In bringing people and countries together to protect water resources, we solve other important tasks, including the maintenance of international peace and tranquility and an ability to understand each other in general, despite language and cultural barriers, and the BSA is the solid base for freshwater collaboration in Asia.

SUBSIDIES FROM AQUATIC TO RIPARIAN CONSUMERS ALONG AN URBAN GRADIENT IN A TROPICAL WATERSHED – A STABLE ISOTOPE ANALYSIS

Kelly, Sean; Ramírez, Alonso

101B
Thursday, 21 May, 2015 15:30 - 15:45

Emerging aquatic insects represent an important food source for many riparian consumers and stable isotope analyses have been a driving force in determining the importance of the flow of subsidies between aquatic and terrestrial ecosystems. Studies have shown that streams are strongly linked to their adjacent riparian areas and impacts in either habitat can have an effect on the biota of the recipient system. Urbanization has a myriad of effects on stream ecosystems, such as increased runoff from impervious surfaces, channelization and impacts to the riparian zone. In this study we conducted stable isotope analyses for tetragnathid spiders and their potential prey along an urban watershed that passes through the heart of the greater San Juan metropolitan area of Puerto Rico. The aim of the study was to find how the importance of aquatic subsidies for riparian consumers may be altered by changes along an urban gradient. We found distinct variation in surrounding urban densities among different stream sections that resulted in changes to the riparian zone however aquatic subsidies remained an important energy source for tetragnathids.

FIRST RECORD OF A SKATING CRANE FLY: THE ECOLOGY, BEHAVIOR, AND TAXONOMY OF THE ENIGMATIC PHANTOLABIS LACUSTRIS (ALEXANDER, 1938) (DIPTERA: TIPULIDAE)

Bouchard, Jr., R. William; Gelhaus, Jon K.

102DE
Thursday, 21 May, 2015 15:30 - 15:45

In 2003, large numbers of pupal exuviae and adults of an unusual crane fly were collected from a trout stream in southern Minnesota (USA). The identity of this species was Phantolabis lacustris (Alexander, 1938), a tipulid for which the immature stages and biology was unknown. Study of the morphology, ecology, and behavior of this unusual tipulid revealed that P. lacustris is the first record of a skating crane fly and several morphological characteristics can be attributed to this behavior. The skating behavior of this tipulid is likely related to its emergence in late winter and early spring. A review of material from biomonitoring and ecological studies and in museum collections indicated that P. lacustris has a broad distribution in the Upper Midwest and Eastern North American. The ability to now identify the larva of P. lacustris is important due to its presence in biomonitoring samples. Previously larvae of P. lacustris have been identified as Hesperoconopa, but the descriptions and geographic distribution provided in this study permit the separation of the larvae of these genera.

APPLICATION OF A NET ENVIRONMENTAL BENEFIT ANALYSIS FOR SUBMERGED DILUTED BITUMEN RECOVERY FOLLOWING THE 2010 PIPELINE RELEASE INTO THE KALAMAZOO RIVER

Fitzpatrick, Faith A.; Capone, Daniel M.; Bejarano, Adriana C.; Williams, Lisa L.; Michel, Jacqueline; Dollhopf, Ralph H.; Kimble, Jeffrey W.; Hamilton, Stephen K.

102B
Thursday, 21 May, 2015 15:30 - 15:45

New science is changing how emergency personnel respond to spills of crude oil into freshwater ecosystems. For the 2010 pipeline release of diluted bitumen into the Kalamazoo River, MI, the Environmental Protection Agency used multiple lines of evidence to determine the extent, transport and fate, and ecological effects of residual submerged oil entrained in river sediment along a 60-km reach of river with three impoundments. Submerged oil was the major focus of cleanup efforts through 2014 after conventional methods recovered the floating component. A team of experts developed a Net Environmental Benefit Analysis (NEBA) and applied it to over 200 tactical response areas in the river. After considering public health and worker safety, the NEBA offered a means for the Federal On-Scene Coordinator and staff to weigh the ecological risks associated with leaving residual submerged oil in place against those associated with removing the oil with proposed recovery actions, including dredging. As tactical areas were updated with new information, the team repeated the use of the NEBA to aid decision-making.

PRIORITIZING WATER QUALITY IMPROVEMENT EFFORTS ON AGRICULTURAL LANDS USING LIDAR ELEVATION DATA

Nelson, Theresa; Ruesch, Aaron

103C
Thursday, 21 May, 2015 15:30 - 15:45

The Wisconsin Department of Natural Resources Bureau of Water Quality has developed the Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) toolset to support the prioritization and implementation of agricultural best management practices for improving surface water quality. It evaluates locations of relative vulnerability to sheet, rill and gully erosion using information about topography, soils, rainfall and land cover. The use of detailed LiDAR elevation data allows for the deprioritization of internally drained areas that are not directly hydrologically connected to surface waters. This tool enables watershed managers to prioritize and focus field-scale data collection efforts, thus saving time and money while increasing the probability of locating fields with high sediment and nutrient export for implementation of best management practices.

LABORATORY EVALUATION OF MACROSCOPIC OIL-PARTICLE-AGGREGATES FORMED FROM DILUTED BITUMEN AND KALAMAZOO RIVER SEDIMENT

Waterman, David; Garcia, Marcelo

102B
Thursday, 21 May, 2015 15:45 - 16:00

Experimental work was undertaken with Cold Lake Blend dilbit and Kalamazoo River sediment samples to provide inputs to a numerical oiled-sediment transport model that was developed as a management tool to guide cleanup efforts associated with the 2010 Kalamazoo River oil spill. The sample of Cold Lake Blend maintained positive buoyancy in freshwater even after all the diluent was volatilized (specific gravity = 0.993 at 20C). The primary challenge of the experimental work was to generate oil-particle-aggregates (OPA) that were qualitatively representative of field-observed OPA: such OPA was anecdotally described as macroscopic “flecks” of tarry debris transported in suspension during initial site response; OPA that submerged to the bed continues to resurface upon bed agitation in macroscopic forms described by field personnel as “globs” of sediment-laden oil. The following laboratory results will be discussed: (1) the mixing environment found to be most advantageous to create such macroscopic OPA; (2) OPA physical characteristics based on analysis with ultraviolet light microscopy; and (3) transport-related properties based on settling column and annular flume tests.

LARGE AQUATIC INSECTS (DICOSMOECUS, CALINEURIA, HESPEROPERLA, AND PTERONARCYS) SHOW DISCORDANT POPULATION STRUCTURE IN THE WESTERN UNITED STATES

Peterson, Michael; O'Grady, Patrick; Resh, Vincent

102DE

Thursday, 21 May, 2015 15:45 - 16:00

Genetic diversity among widely distributed populations can indicate structuring and, indirectly, the dispersal ability of organisms. The caddisfly Dicosmoecus gilvipes, and stoneflies Calineuria californica, Hesperoperla pacifica, and Pteronarcys californica are common lotic species in western North American rivers, ranging from California to British Columbia. These species have large bodies and wings, suggesting strong flying ability, yet have biological behaviors (e.g. mating habits) that make dispersal to other watersheds less likely. We collected each species across its range (>12 sites), sequenced mitochondrial (COI, COII) and nuclear (Wingless) genes, and used concatenated sequences (1700 base pairs) to create phylogenies with maximum likelihood (ML) and Bayesian inference. We found genetic structuring between populations north and south of San Francisco bay for D. gilvipes, P. californica, and C. californica (ML bootstraps > 75%, Bayesian posterior probability > 0.9), and between Sierra Nevada and lowland populations for D. gilvipes and C. californica (ML bootstraps > 80%, Bayesian posterior probability > 0.8). H. pacifica, however, showed weak population structure across its range, suggesting different phylogenetic history or different geographic constraints on species dispersal.

HOW TOLERANT ARE TROPICAL STREAM MACROINVERTEBRATES TO DROUGHT-DRIVEN ACIDIFICATION ASSOCIATED WITH CLIMATE CHANGE?

Ganong, Carissa; Hidalgo Oconitrillo, Minor; Pringle, Catherine

101B
Thursday, 21 May, 2015 15:45 - 16:00

The severity of drought-driven stream acidification may increase worldwide in response to increased drought frequency and intensity resulting from climate change. Some lowland Neotropical streams experience seasonal acidification and are particularly vulnerable to extreme drought-driven acidification. We conducted laboratory experiments to determine thresholds of pH effects on growth/survival of three stream macroinvertebrate taxa at La Selva Biological Station, Costa Rica: mayfly naiads (Traverella holzenthali), chironomid larvae (Chironominae), and adult shrimp (Macrobrachium olfersii). To determine possible local adaptation, we compared effects of pH on growth/survival of larval chironomids from two different streams: a typical poorly-buffered stream (pH 4.32-6.94) and a naturally well-buffered stream receiving high-bicarbonate regional groundwater (pH 5.11-6.92). Chironomid growth and survival were unaffected by pH >3.5, indicating tolerance to pH levels experienced in poorly-buffered streams. However, mayflies and shrimp showed decreased tolerance to the lowest pH levels (3.6-4.0) recorded during an extreme climatic (ENSO) event, suggesting that increasingly severe drought-driven acidification could negatively affect macroinvertebrate survival. These findings signal the need for further research on macroinvertebrate tolerance thresholds in streams worldwide where drought-driven pH declines are probable.

DATABASE APPROACHES FOR RAPID CONSTRUCTION OF SPATIALLY EXPLICIT WATER QUALITY MODELS

Ruesch, Aaron; Diebel, Matt; Menuz, Diane

103C
Thursday, 21 May, 2015 15:45 - 16:00

Understanding landscape drivers of water quality requires analysis within a spatial context. Site-specific water quality rarely depends only on the physical properties at the sampling location, but rather a multi-scale combination of site-specific and cumulative upstream drivers. A major barrier in modeling landscape drivers of water quality lies in the time and energy required to compile multi-scale data. Ongoing efforts are currently underway to gain efficiencies in water resources modeling by compiling databases where these attributes have been pre-processed, the most well-known being NHDPlus. Here, we present a Wisconsin-specific database of site-specific and cumulative characteristics to enhance the spatial resolution and number of watershed attributes available to modelers. Using scalable cloud computing to process large quantities of data, we pre-processed watershed and riparian characteristics and stored the resulting data in a light database format that enables easy extraction of thousands of attributes. The database format opens new frontiers for data storage, sharing, and analysis, resulting in efficient construction of numerous insightful models and the ability to conduct analyses across the Internet.

ORIGIN OF AQUATIC INSECTS OF ICELAND WITH EMPHASIS ON CADDISFLIES

Gislason, Gisli; Palsson, Snaebjorn

102DE
Thursday, 21 May, 2015 16:00 - 16:15

Biological diversity of the Arctic has been shaped by the Pleistocene glacial periods. Species have diverged in allopatric areas during prolonged periods and expanded their distribution following the retreat of the glaciers. Genetic patterns of reflect these climatic impacts. Origin of two Trichoptera species, the Palaearctic Potamophylax cingulatus and the Holarctic Apatania zonella and the variation of the COI gene of the mtDNA in Iceland and from their distribution ranges of the species were studied. In P. cingulatus, which colonized Iceland during the 20th century, no variation was detected in the Icelandic population, and the flies were closely related to flies from the Faroes. The Icelandic population of A. zonella, a species with highly skewed sex ratio was analysed both for the COI gene and three nuclear. The genetic patterns revealed two lineages, one Nearctic and other Palearctic which diverged during last Ice Age. Both lineages co-occur in Iceland and in few specimens from Alaska and Yukon, where high diversity is observed. Icelandic aquatic insects is mainly of Palaearctic origin, but these two examples show two different ways of colonization.

A MAJOR DILUTED BITUMEN (OIL SANDS) SPILL INTO THE KALAMAZOO RIVER (MICHIGAN): WHAT WE KNOW AND WHAT WE NEED TO LEARN

Hamilton, Stephen K.; Desotelle, Micaleila

102B
Thursday, 21 May, 2015 16:00 - 16:15

Diluted bitumen from the oil sands (tar sands) of western Canada is increasingly being transported to US markets, and would flow in the Keystone XL pipeline if approved. North America's largest inland oil spill and the first major oil sands spill in a freshwater environment occurred in 2010, when at least 843,000 gallons leaked from a pipeline into the Kalamazoo River of southwest Michigan. Cleanup of this oil was unusually difficult and protracted, lasting through 2014 and costing over a billion dollars, largely because a substantial fraction of the oil became submersed and deposited in slack water areas over 60 km or river channel, reservoirs, and floodplain backwaters. I summarize the scientific understanding of the ecological effects of this oil in the riverine environment and highlight areas where we need better information. Toxicity of the bitumen, its eventual biodegradation above and below water, and its propensity to form surface sheen are highly uncertain. Other talks in this session will discuss the transport and fate of submerged oil in more detail.

OPTIMIZING WATERSHED FLUX ESTIMATES: THE R PACKAGE 'LOADFLEX'

Appling, Alison; Leon, Miguel; McDowell, William H.

103C
Thursday, 21 May, 2015 16:00 - 16:15

Insights into the function of rivers and watersheds often emerge when we quantify riverine solute fluxes. Many flux estimation methods are available, and the best method for each dataset may depend on the solute of interest, the land use and hydrology of the watershed, and the site position within the river network. Here we present a new R software package called loadflex that implements several prominent methods for flux estimation, including regressions, period-weighted methods, and a recently developed approach called the composite method. To demonstrate, we use loadflex to quickly analyze data from the Lamprey River, New Hampshire, where two large floods in 2006-7 are hypothesized to have driven a long-term shift in nitrate fluxes. Several competing estimation methods each give believable flux estimates, and yet (1) they yield different answers for whether and how the floods altered nitrate fluxes, and (2) the best method differs for main-stem versus tributary sites. Our R package simplifies the process of comparing flux estimation methods and drawing conclusions such as these, ultimately allowing researchers to estimate riverine fluxes with greater ease and accuracy.

DISTURBANCE AS A KEY FACTOR IN UNDERSTANDING MACROINVERTEBRATE ASSEMBLAGE DYNAMICS IN NEOTROPICAL STREAMS

Ramírez, Alonso

101B
Thursday, 21 May, 2015 16:00 - 16:15

Natural and anthropogenic disturbances are common and important phenomena affecting stream ecosystems and play key roles determining benthic macroinvertebrate assemblage dynamics. Moreover, understanding macroinvertebrate responses to disturbance is the basis of biomonitoring efforts. While we still have much to learn about macroinvertebrate responses to both disturbance types, we have little information on the interaction between the two. How do natural disturbances affect our ability to evaluate the ecological condition of streams? Here we explore our understanding of the importance of disturbances in structuring macroinvertebrate assemblages in neotropical streams. We use information from our long-term monitoring studies in lowland streams in Costa Rica to highlight the importance of hydrological disturbances in shaping macroinvertebrate assemblages. Information from urban studies in Puerto Rico provide context for the importance of anthropogenic disturbances and for the interactions between these and natural disturbances. Overall, disturbances create complex dynamics in macroinvertebrate assemblages, often with changes in composition and abundance. However, the potentially complex interaction between natural and anthropogenic disturbances and their effects on macroinvertebrates remain an open field of study.

A MAJOR DILUTED BITUMEN (OIL SANDS) SPILL INTO THE KALAMAZOO RIVER (MICHIGAN): WHAT WE KNOW AND WHAT WE NEED TO LEARN

Hamilton, Stephen K.; Desotelle, Micaleila

102B
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LANDSCAPE APPROACHES TO NUTRIENT AND SEDIMENT MANAGEMENT IN STREAMS: PAST RESEARCH AND FUTURE DIRECTIONS

Baker, Matthew

103C
Thursday, 21 May, 2015 16:15 - 16:30

Scientific investigation of excess nutrient and sediment contributions has emphasized various aspects of management problems, including sources, transport and transformation dynamics, potential storage and sinks, and management techniques for mitigating impacts of widespread and intensifying human activity. Source characterization has ranged from plot-level measurement to watershed-scale yield estimates. Likewise sinks and potential storage zones have been described with increasing levels of precision across space and time, often revealing surprising variability and hotspot/moment behavior. Substantial advances in geographic representation and analysis provide watershed-scale perspectives of the broader context in which nutrient or sediment loading and processing occurs. Increased sophistication has heightened understanding, but will advances in knowledge translate to more effective management? Recent work has emphasized precision targeting and prioritization in space, but additional progress may result from understanding interactions through time. Further, management prioritization benefits from explicit integration of a menu of mitigation options that avoids "once size fits all" approaches. Investigators can aid the efficiency of management decisions by integrating uncertainty about different mitigation strategies and practices into predictions, and emphasizing first principles in policy-relevant communication.

LANDSCAPE APPROACHES TO NUTRIENT AND SEDIMENT MANAGEMENT IN STREAMS: PAST RESEARCH AND FUTURE DIRECTIONS

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103C
Thursday, 21 May, 2015 16:30 - 16:45

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We characterized the dynamics of turbulent exchange between surface and porewaters in a 2.5 m recirculating flume. The channel was packed with 3.8 cm PVC spheres to form a coarse gravel bed, with a total depth of 21 cm. We implanted microsensors onto an array of spheres to measure in situ salt concentrations within the streambed. Water was recirculated in the channel, and concentrated salt solution was continuously injected upstream of the sensor array.

We observed high-frequency (1-10 Hz) concentration fluctuations at bed depths of at least 4.75 cm, and sporadic low-frequency fluctuations at depths of 12.5 cm. Spectral analysis revealed increased filtering of high frequencies with depth. These results demonstrate that turbulent mixing impacts hyporheic exchange deep into permeable streambeds.

P-1: THE ROLE OF PHYLLOICUS PULCHRUS (TRICHOPTERA: CALAMOCERATIDAE) IN THE DECOMPOSITION OF LEAF LITTER: EVALUATING LEAF SPECIES AND CASE BUILDING EFFECTS

Limarie Reyes, Pedro Torres

S01: SS: Freshwater Futures - Undergrads

Phylloicus pulchrus larvae are exclusive leaf feeders and key contributors to leaf processing in tropical streams. Previous studies have determined their feeding preferences, case building behavior and role as shredders. There is limited information on their effects on decomposition in terms of material used for consumption and case building. We determined the influence of P. pulchrus larvae on leaf litter decomposition in Puerto Rico. Our main goals were to assess the effects of leaf species and availability on leaf decomposition and evaluate the effects of leaf selection for case building. Results indicate that this shredder is able to discriminate among different leaf species that differ in structure and chemical composition resulting in differences in decomposition rates among species. Our findings indicate that leaf decomposition rates are affected by whether leaves are used for case building or consumption. P. pulchrus behavior may potentially play a major role in ecosystem processes, such as FPOM transport, since the case material is not released into the water column.

P-2: INTEGRATING VISUOSPATIAL APPROACHES INTO RESEARCH READING AND WRITING

Patina Mendez, Teri Crisp

S01: SS: Freshwater Futures - Undergrads

Students and researchers draw on extensive sources from published literature, requiring the ability to sort source materials, while reading deeply to extract content. The cognitive burden of the material volume, alongside lower comprehension and retention rates for digital reading, may cause anxiety for novice researchers who have trouble visualizing the form of the manuscript and lack heuristics to organize and generate ideas. We present curriculum activities for reading and writing that engage visuospatial processes in the brain and critical thinking. For reading, three activities step students through a process for understanding and evaluating source material: “Analyzing Arguments” introduces vocabulary for elements of argument; “Questions to Ask a Text” steps students through categories of inquiry; and “Passage Analysis” is a tactile and spatial activity that isolates textual evidence from the parent document, allowing for students to mark up, code, and connect content with other material. For writing, students learn to “Extract and Organize Information” from the literature before outlining through an activity that pairs note-taking in PowerPoint with spatial and tactile arrangement on paper to generate arguments.

P-3: PROMOTING DIVERSITY IN FRESHWATER SCIENCE THROUGH MENTORING: CELEBRATING FIVE YEARS OF INSTARS

Tamara Sluss, Checo Colon-Gaud, Krista Capps, Patina Mendez, Judy Li, Marcelo Ardon-Sayao

S01: SS: Freshwater Futures - Undergrads

Instars is a mentoring program for undergraduate students from under-represented groups who are interested in the study of fresh waters. This year, the program will include an orientation workshop and will sponsor a special session entitled, “Our freshwater futures: an educational session particularly for undergraduates”. Instars began at the 2011 meeting in Providence, RI with 6 Fellows and 3 graduate mentors representing 7 states and 8 institutions. Participation has expanded and at the Joint Aquatic Sciences meeting in 2014 there were 16 Fellows and 8 mentors. Three of the mentors were alumni of the program. A broad diversity of under-represented groups, including African Americans, Hispanic/Latinos, Asian Americans, Native Americans, and First-Generation College students have participated in Instars, with at least 6 alumni continuing into SFS-related graduate programs. To date, funding has been provided by the Society for Freshwater Science for more than $50K with substantial assistance from partnering institutions. Institutions may help expand Instars by sponsoring undergraduates to attend the conference. We strongly encourage institutional sponsorship and are seeking resources to help provide stable funding for this growing program.

P-4: PREDICTING THE CONSEQUENCES OF GLOBAL CLIMATE CHANGE ON POND-BREEDING SALAMANDERS IN THE MIDWESTERN UNITED STATES

Brock Struecker, Joseph Milanovich

S02: SS: Species Distribution Models

Global climate change has become of increasing concern for herpetologists over the past decade because of its potential effects on physiological responses. Few studies have focused on modeling climate change effects on amphibians in the United States and those that have are limited to the areas of diverse amphibian species richness (e.g., southeastern United States). Other geographic regions of the United States such as the Midwest have not been examined. Pond-breeding salamanders are the most common taxonomic genus of salamander in the Midwest and localized extinctions in the Midwest are of increasing concern. My research objectives were to (1) use Species Distribution Models (SDMs) to quantify distributional changes and (2) define criteria for areas of conservation priority for pond-breeding species in the Midwest. An ensemble of distributions were created as a result of modeling three decades (current, 2050, and 2070) along with two global circulation models, with two carbon dioxide outputs (rcp26 and rcp85) per GCM. These data show large changes in the distribution of pond-breeding salamander species across the Midwestern United States and highlight the importance for further study.

P-5: A COMPARISON OF SILVER CARP HABITAT AVAILABILITY IN A 10-KM STRETCH OF THE WABASH RIVER

Luke Etchison, Mark Pyron

S02: SS: Species Distribution Models

Silver carp (Hypopthalmichthys molitrix) is an invasive species of growing concern in the United States. Silver carp directly compete with larval fish and planktivores, including bigmouth buffalo and gizzard shad. Ecological niche modeling of silver carp has provided detailed habitat information and niche overlap with competing species. However, temporal variation in preferable habitat is rarely investigated. We evaluated available habitat for silver carp for a 10-km stretch of the Wabash River during a dry year (2012), a typical year (2013), and a wet year (2014). Temporal variation of available habitat will allow us to further understand invasion risks of silver carp.

P-6: CHARACTERIZATION OF THE ALGAL AND MACROINVERTEBRATE COMMUNITIES OF TWO VERNAL POOLS AT TIDD-OAKES FARM, HARDIN COUNTY, OHIO

Kelsey Weidner

S02: SS: Species Distribution Models

Limited research has been conducted on lower trophic levels in vernal pools despite their significant contributions to food web dynamics. In May 2013, two vernal pools located in two different habitats (prairie and woodland) were sampled at the Ohio Northern University Tidd-Oakes Farm in Hardin County, Ohio, USA, to determine the vascular plant, algal, macroinvertebrate and amphibian community composition and their corresponding physicochemical conditions. Each pool was dominated by different vascular plants - herbaceous species at the prairie pool (Eleocharis erythropoda and Leersia oryzoides) and woody species (Acer saccharum) at the woodland pool. The prairie pool was also characterized by different dominant taxa and higher taxa richness for a variety of aquatic or semi-aquatic organismal groups (macroalgae, macroinvertebrates and amphibians). Preliminary results suggest that a combination of high light levels, greater macrophyte density and increased spatial heterogeneity in the prairie pool could be contributing to higher taxa richness in this habitat. Current analysis of periphyton communities will be used to characterize an additional trophic level, further expanding our understanding of food webs in vernal pools.

P-7: CAUSAL FACTORS OF RECOVERY OF ISOËTES ECHINOSPORA AND I. LACUSTIS IN TWO ACIDIFIED SOFTWATER LAKES

Martina Ctvrtlikova, Jaroslav Vrba, Petr Znachor, Jiri Kopacek, Petr Hekera, Jiri Jarosik, Andrew Wade, Shovonlal Roy

S04: SS: Acid Deposition

Quillworts (Isoëtes) represent highly specialised flora of softwater lakes that is sensitive to acidification. Environmental drivers of recovery of Isoëtes echinospora and I. lacustris were studied in two acidified lakes in Bohemian Forest (Central Europe). Both populations survived a 30-year period of severe acidification, when they failed to reproduce. Unlike I. lacustris in Cerné Lake, a renewal of I. echinospora in Plesne Lake has been observed since 2005. Our experiments revealed that germination of the quillworts has been controlled by lake water acidity and aluminium toxicity as well as species-specific phenology. Analyses of environmental forcing of the I. echinospora recovery showed that sporeling growth is related to pH and aluminium thresholds while later, growing juveniles are responsive to water temperature and phosphorus availability. As quillworts do not grow clonally, the long-term survival of both populations relies entirely on the resistance of long living adult plants. Our study brings novel findings to recently discussed issues of long-term degradation of softwater lakes, which represent an important component of the European biodiversity.

P-8: SENSITIVITY OF SEEPAGE LAKES IN NORTHERN WISCONSIN TO ACID DEPOSITION

Nora Casson, Steve Sebestyen, Randall Kolka, Emily Stanley

S04: SS: Acid Deposition

The ability of a lake to buffer acid deposition is mediated by the hydrological delivery of solutes through surface runoff or groundwater. Although acid deposition has declined in northern Wisconsin, seepage lakes in this region remain sensitive to acidification due to their small catchment areas. This sensitivity may vary due to differences in hydrology and catchment features. The objective of this study is to present a framework by which to classify the vulnerability of these lakes to acid deposition through geochemical mixing analysis. We present data from synoptic surveys of more than 90 seepage lakes across northern Wisconsin that ranged in size from 1.6 to 75 ha, sampled during the summers of 2013 and 2014. Mixing model analysis revealed that inputs to these lakes are dominated by precipitation (accounting for 63-100% of lake water). Groundwater input is also positively correlated with absorbance and dissolved organic carbon concentrations, important factors in controlling the organic acidity of these lakes. These results suggest that hydrology is a dominant factor in determining the sensitivity of these systems to environmental change.

P-9: WIDESPREAD OCCURRENCE OF A SUBTERRANEAN AMPHIPOD IN ACIDIC SURFACE STREAMS OF SOUTH-CENTRAL PENNSYLVANIA

Theo Light, Alicia Helfrick, Natasha Wingerter

S04: SS: Acid Deposition

Amphipods are common and abundant in springs, caves, and groundwater, particularly in karst regions, and several hundred exclusively stygobiont species are known. Stygobromus allegheniensis, the most widespread subterranean amphipod in the Ridge and Valley Province, is known from surface streams, though most published records are from caves or groundwater. In the course of other research, we collected macroinvertebrates from 41 sites in 20 first through third-order streams and springs in the Susquehanna and Potomac drainages. S. allegheniensis was widespread in our region, and showed a striking association with low-pH, low-conductance surface streams. We found S. allegheniensis in 90% (18/20) of sites with pH < 5.5, at densities ranging from 0.7-20/m2, and in 5% (1/20) of sites with pH > 6.0. The pH of sites with S. allegheniensis averaged 4.70 (±0.11), whereas limestone-influenced valley-floor sites with spring-associated amphipods (Gammarus minus and G. fasciatus) averaged 7.63 (±0.15). Sites lacking amphipods were mainly circumneutral mountain sites with mean pH 6.17 (±0.18). The strong association of this subterranean species with acidic streams may reflect their distinctive hydrogeology and/or relative lack of fish predation.

P-10: PATTERNS AND DRIVERS OF LAKE STOICHIOMETRY ACROSS A 17-STATE REGION IN THE U.S.

Samantha K Oliver, Sarah M Collins, Emily Stanley, Patricia A Soranno

S05: SS: Nutrient Reaction Rates and Residence Times

The stoichiometry of limiting nutrients affects important ecosystem functions, ranging from carbon sequestration to energy transfer in food webs. Lake N:P is affected by diverse nutrient loading ratios that are related to land cover and use. Internal lake processes may also influence N and P in contrasting ways because of differences in biogeochemical pathways of these constituents. We hypothesized that stoichiometry across lakes would be related to land use at broad spatial scales, but that differences in morphology and related features (e.g., sedimentation, residence time) alone could create divergent patterns in stoichiometry. Lake nutrient, landscape and morphological data were used to assess stoichiometry in 2,013 lakes across a 17-state region of the U.S. The mean TN:TP (molar) of all lakes was 88.7, and variability in TN:TP across lakes (CV=0.94) was higher than variability within lakes (CV=0.43). Lakes in watersheds with high development (>60%) generally had lower TN:TP (n = 107, mean = 69.9), but maximum depth was positively related to TN:TP in these lakes ($R2=0.14$, $p=0.005$). This may suggest that in deep lakes, permanent burial of phosphorus promotes high TN:TP.

P-11: ABUNDANCE AND DISTRIBUTION OF CRAYFISH IN TWO FLORIDA SPRING-FED RIVERS

Tiffani Manteuffel

S06: SS: Invertebrate Systematics and Faunistics

Freshwater provides valuable ecosystem processes and services like nutrient cycling, food and potable water. Animals, particularly invertebrates, impact nutrient cycling in freshwater through consumption, burrowing and waste production. Crayfish are an economically and ecologically important invertebrate. They are a common food source for humans and are commercially harvested and farmed worldwide. Crayfish ecology research in native habitats, particularly in Florida, is limited. This study will investigate patterns of abundance and distribution of crayfish in two Florida spring systems. Do crayfish abundance and distribution patterns vary by abiotic and biotic habitat parameters and season? I will implement a systematic sampling design in Wakulla and Silver River using minnow traps to catch crayfish. Abundance will be assessed with N-mixture models and with parameters such as vegetation, detritus composition, water depth, dissolved oxygen, distance to spring and season. This study will fill knowledge gaps on Florida crayfish ecology. These results can help managers tailor practices to understand and prevent negative impacts to these fauna. Understanding crayfish ecology is important to nutrient cycling, an ecosystem process.

P-12: A PROPOSAL FOR THE INTEGRATION OF LONG TERM BENTHIC COMMUNITY VARIABILITY IN CURRENT ECOLOGICAL ASSESSMENT SYSTEMS

David G. Armanini, Almudena Idígoras Chaumel, Wendy Monk, Adam Yates

S08: SS: Accounting for Variability

It is now widely accepted that modern assessment systems cannot rely on the assumption that community composition is stable through time and that the vast majority of the observed changes are mechanisticly linked to anthropic activities. Long term biological datasets collected in southern Ontario using the Canadian Aquatic Biomonitoring Network (CABIN) protocol were matched with relevant environmental variables, including water quality, hydrological and land use data. A comparison of several biological community descriptors, including presence absence composition, relative abundance metrics and a number of common biological metrics were employed to compare the relevance and the intensity of such temporal variability. The analysis showed that communities vary substantially among years both in terms of species turnover and on community assemblage, while some metrics, such as CEFI and Hilsenhoff index showed limited temporal variability. A number of potential approach to minimize the impact of such source of variability on current ecological assessment in use in Canada are suggested.

P-13: VARIATION IN MORPHOLOGY OF NORTHERN CRAYFISH (ORCONECTES VIRILIS) DUE TO LATTITUDE, SEXUAL DIMORPHISM, AND WATERSHED AREA

Robert Shields

S08: SS: Accounting for Variability

Variation in latitude, gender, and watershed area can lead to dramatic changes in the morphological characteristics of aquatic organisms. In an open agricultural landscape, watershed area greatly affects the flow regime of a stream. We tested these effects on Northern crayfish (Orconectes virilis) in Illinois by analyzing specimens collected by the Illinois Natural History Survey. The dorsum of each specimen was photographed and analyzed for variation using geometric morphometrics. We discovered a strong effect of watershed size on male crayfish morphology as well as a latitudinal effect that could be related to climate. These results indicate a need for further study to aid in conservation of threatened species, and predict ecosystem effects on invasive species of crayfish worldwide.

P-14: CARBON LIMITATION PATTERNS IN BURIED AND OPEN URBAN STREAMS

Clay Arango, Jake J. Beaulieu, Ken Fritz, Brian Hill, Colleen Elonen, Michael Pennino, Paul Mayer, Sujay Kaushal, Adam Balz

S09: SS: Dynamics of Carbon

Urban streams alternate between darkened buried segments dominated by heterotrophic processes and lighted open segments dominated by autotrophic processes. We hypothesized that labile carbon leaking from autotrophic cells would reduce heterotrophic carbon limitation in open channels, whereas the lack of carbon fixation in buried channels would reduce labile carbon production and exacerbate heterotrophic carbon limitation. To test this hypothesis, we deployed nutrient diffusing substrata (NDS) with increasingly labile forms of carbon (cellobiose, arabinose, glucose) and a control into paired open and buried reaches in three streams seasonally. Expressed on an areal basis, heterotrophic respiration on the carbon-amended NDS was higher than the control in all reaches (2-way ANOVA, $p<0.001$), but there was no carbon lability effect. Therefore, heterotrophic respiration was carbon limited in all reaches, despite the presumed availability of labile carbon from autotrophic processes in open reaches. However, heterotrophic respiration expressed on a biomass basis did not differ among carbon types or between stream reaches. Thus, heterotrophic biofilms in open and buried reaches were carbon limited and accrued biomass in response to the addition of even relatively recalcitrant carbon.

P-15: TERRESTRIAL LEAF LITTER INCREASES SEDIMENT OXYGEN DEMAND AND ALTERS NUTRIENT FLUX IN SEDIMENTS FROM A SMALL MAN-MADE POND IN CENTRAL VIRGINIA

Kaitlyn Peters, Kenneth Fortino

S09: SS: Dynamics of Carbon

The importance of terrestrial leaf litter in streams is well established but less is known about the impact of leaf litter in lentic systems, particularly man-made ponds. We hypothesized that leaf litter would increase sediment oxygen demand (SOD) and reduce the flux of inorganic N and P out of the sediments. Litter-free pond sediment from a 0.06 ha man-made pond in central Virginia was incubated in the dark for 22 days unamended, with added leaf litter, with added inorganic N and P, or with both added leaf litter and inorganic N and P. Sediment oxygen demand and nutrient flux was determined on 5 dates during the incubation. Our results show that sediments with leaf litter had greater SOD during the first week of the experiment but returned to control levels by day 22. Nutrient additions also significantly increased SOD but there was no interaction between the effects of leaf litter and nutrient additions. The leaf litter altered the timing and magnitude of nitrate and nitrite flux but had a smaller effect on ammonia and ortho-phosphate.

P-16: NITROGEN TURNOVER AND RAPID CYCLING OF ALGAL EXUDATES IN EPILITHIC BIOFILMS

Jonathan O'Brien, Ryan Koch, David Kerling, Courtney Marlinski, Molly Christie

S09: SS: Dynamics of Carbon

We examined the response of N turnover in epilithic biofilms to increasing nitrate concentrations. Cobble substrates were collected from 9 streams in western New York and were incubated in recirculating chambers in the lab. Across all streams, nitrate uptake by biofilms repeatedly showed a consistent, unexpected inhibition response to the sequential increases in nitrate concentration. Nitrate uptake rates increased with concentration between 0.1 – 0.5 mg-N/L, but then sharply decreased at concentrations higher than 0.75 mg-N/L. The apparent nitrate inhibition pattern was due to rapid increases in ammonium concentration and increases in the production of algal exudates that coincided with the highest nitrate concentrations. Microbial enzyme activities showed that the biofilms had elevated leucine-aminopeptidase (LAP) activities, indicating a capacity to rapidly break down peptides within the biofilm. This rapid increase in algal exudate production and breakdown may explain the sudden elevation in ammonium concentrations and decrease in nitrate uptake. Our research suggests that rapid production and breakdown of algal exudates within epilithic biofilms may act as a controlling mechanism for nitrogen cycling in streams.

P-17: NITRATE LOADING REDUCES THE CAPACITY FOR NITRATE UPTAKE IN EPILITHIC BIOFILMS

Ryan Koch`, David Kerling, Courtney Marlinski, Molly Christie, Jonathan O'Brien

S09: SS: Dynamics of Carbon

Field studies have noted a loss of nitrate uptake efficiency in streams with increasing nitrogen loadings, but the mechanisms behind this pattern have not been explored. We conducted laboratory incubations of epilithic biofilms to assess how increases in nitrate concentrations effect the capacity for nitrate uptake. Cobble substrates were collected from Cattaraugus Creek in western New York and were incubated for 3 weeks in recirculating chambers in the lab at four different nitrate treatments (0.1, 0.5, 5 and 25mg/L). At the end of the incubation period, nitrate uptake was measured at four concentrations of nitrate (100, 200, 500, and 1000 ug/L) to access the functional response. The functional response of nitrate uptake was linear across all nitrate treatments; however, the slope of the linear response decreased with increasing nitrate loading. Our results show that chronic nitrate loading did not saturate nitrate uptake, but the chronic nitrate loading did decrease the biofilm’s affinity for nitrate. These results support the findings of the field studied and provide a mechanism for the efficacy loss pattern.

P-18: FURTHER INSIGHTS INTO DOM-METAL INTERACTION BY PARAFAC ANALYSIS COMBINED WITH TWO-DIMENSIONAL CORRELATION SPECTROSCOPY

Huacheng Xu

S09: SS: Dynamics of Carbon

Fluorescence excitation–emission matrix (EEM) quenching titration coupled with parallel factor (PARAFAC) analysis is a widely used tool to characterize DOM-metal interaction, while information on the metal binding with non-fluorescent substances cannot be obtained. In this study, the metal binding properties of both fluorescent and non-fluorescent substances in a eutrophic algae-rich lake were investigated by using PARAFAC analysis combined with two dimensional fourier transform infrared correlation spectroscopy (2D-FRIR-COS). PARAFAC model showed that fluorescent tyrosine- (logKM > 5.21) and humic-like substances (logKM > 4.84) in natural organic matter (NOM) fraction exhibited higher metal binding capacities than those in extracellular polymeric substance (EPS) matrix. Furthermore, algal EPS was characterized with a high metal-tryptophan-like substances affinity (logKM > 5.08). 2D-FTIR-COS, however, demonstrated that the binding susceptibility of organic ligands in both NOM and EPS followed the same order: 3400 > 1380 > 1650 cm-1, indicating the significant contribution of non-fluorescent ligands in metal binding. Additionally, the orders of logKM values calculated were consistent with those derived from asynchronous correlation spectroscopy. PARAFAC analysis combined with 2D-COS can provide a deeper understanding on DOM-metal interaction.

P-19: EFFECT OF DIFFERENT NATURAL ORGANIC MATTER ON PYRENE AND BENZO[A]PYRENE BIODEGRADATION IN FRESHWATER SEDIMENTS

Zaisheng Yan, Helong Jiang

S09: SS: Dynamics of Carbon

The biodegradation of pyrene and benzo[a]pyrene (BaP) were investigated in freshwater sediments with amendment of seven different organic matters including cyanobacteria-derived organic matter (COM), plant-derived organic matter (POM), and humic substances (HS). During the 210 days of experiments, the amendment of COM or HS enhanced significantly the removal of pyrene and BaP in sediments, especially with fresh COM (FCOM) treatment much superior to HS. On the contrary, degradation of these polycyclic aromatic hydrocarbons (PAHs) was not significantly improved and even inhibited in POM-amended sediments. The first-order rate constants of pyrene and BaP degradation in the FCOM-amended sediments reached 0.00540±0.00017 d-1 and 0.00517±0.00057 d-1 respectively, and were about three and five folds of those in the control treatment. The enhanced PAHs degradation in FCOM-amended sediments was related to higher PAH-degrading bacteria number and bioavailability with a result of biostimulation and priming effect by labile carbon and high-value nutrition in FCOM. Thus, this study improved our understanding about effects of settled biomass from cyanobacterial blooms, which occurred frequently in eutrophic aquatic ecosystems, on the natural attenuation of PAHs in sediments

P-20: EFFECTS OF RESUSPENSION ON METAL DYNAMICS AND SPECIATION IN CONTAMINATED LAKE SEDIMENTS

Minwei Xie

S09: SS: Dynamics of Carbon

Evolution and fate of metals are strongly regulated by the coupling of hydrodynamic transport and biogeochemistry in sediments and pore waters. Therefore, it is extremely important to understand how they interact to affect the mobility of metals in sediments. We conducted a series of experiments to study the effects of flow hydrodynamics, especially resuspension, on mobilization and redistribution of metals in sediment. Characterization of dissolved Zn revealed that surficial pore water was source of the Zn efflux to overlying water and resuspension events facilitated the release of Zn to surficial pore water and overlying water. X-ray absorption spectroscopy (XAS) analysis showed oxidation of surficial sediments promoted the formation of weakly bound metal species and liberated aqueous Zn. XAS analysis also indicated ongoing dissolution of resuspended sediment particles liberated Zn during the resuspension event. The results clarified oxidation and dissolution of Zn-sequestered species in sediments are the primary mechanism that controls the mobilization of Zn in sediments. Episodic sediment resuspension enhances dissolution and contributes to a net efflux of Zn to pore water and overlying water.

P-22: STOCHASTIC MODELING OF CARBON PHOTO-MINERALIZATION ALONG ARCTIC RIVERS

Angang Li, Antoine Aubeneau, Tyler King, Rose Cory, Bethany Neilson, George Kling, Diogo Bolster, Aaron Packman

S09: SS: Dynamics of Carbon

The primary driver of CO2 production in arctic inland waters is photo-mineralization, the oxidation of dissolved organic carbon (DOC) to CO2 by light. DOC movement in rivers alters its availability and reactivity, yet has been overlooked in estimations of CO2 production. To better understand what controls the fate of carbon in the arctic, we developed a stochastic model that represents DOC behavior in the Kuparuk River, Alaska by accounting for advection, dispersion, and photochemical reaction in the river water column. Vertical mixing in the water column replenishes DOC concentrations in the photo-active near-surface region, therefore increasing the rate of CO2 production. The interfacial exchange with underlying sediments, on the other hand, reduces the rate of CO2 production by storing DOC in a region where photo-mineralization does not occur. DOC movement must be modeled to accurately assess photochemical reaction of carbon in arctic rivers. This model enhances our understanding of the interactions between hydrological and photochemical controls on CO2 production in surface waters, and improves modeling capacity on carbon processing in fluvial environments.

P-23: EFFECTS OF HELOPHYTES ON AQUATIC NUTRIENT DYNAMICS: RESULTS FROM A MESOCOSM EXPERIMENT

Myrto - Georgia Nikolakopoulou, Alba Argerich, Esperança Gacia, Eugènía Martí, Albert Sorolla, Francesc Sabater

S09: SS: Dynamics of Carbon

Plantation of macrophytes is a common technique used for the restoration of riverine floodplains. Here we use an outdoor mesocosm experiment to investigate the effects of helophyte Iris pseudachorus L. on pore water quality of floodplain ecosystems. We set up a two crossed factor experiment with two levels of porosity (high and low) and plant presence. Three replicated plots per treatment, making a total of twelve mesocosms, are flooded with water from the effluent of a waste water treatment plant. Pore water samples have been collected at three different sediment depths and analyzed for carbon, nitrogen and phosphorus compounds. Further, we link the effect of helophytes on the spatial and temporal dynamics of nutrients, with porosity and dissolved oxygen profiles. Water samples from the different sediment types showed differences in the range of oxygen and nutrient concentrations, indicating that porosity is a primary driving factor to the observed biogeochemical processes. The above exploratory experiment will provide knowledge about how to enhance riverine floodplains' role as buffer zones and retention areas and will serve as a basis to our further research.

P-24: COMPOSITION AND FLUX OF DISSOLVED ORGANIC MATTER FROM THE LOWER MILWAUKEE RIVER

Tarek Teber, Stephen DeVilbiss, Zhengzhen Zhou, Peng Lin, Laodong Guo

S09: SS: Dynamics of Carbon

Physical, chemical and biological processes directly influence the transport, composition, and fluxes of dissolved organic matter (DOM) in watersheds. A literature search to date finds no comprehensive accounting of DOM in the Milwaukee River. Monthly water samples were collected between Feb-2014 and Jan-2015 for the measurements of hydrographic parameters, bulk dissolved organic carbon (DOC), chromophoric-DOM and fluorescent-DOM to determine temporal variations in source and composition of DOM in the lower Milwaukee River and fluxes of DOM to Lake Michigan, as well as influence of human activities in the river basin. Preliminary data showed that the concentration of DOC varied from 318 μM-C under the ice to 1,189 μM-C in spring season, with an average of 826±246 μM-C. Absorption coefficient (a254nm) averaged 80 ±37 m-1, and shows a significant correlation with DOC. Non-chromophoric DOC represents ~29% of the bulk DOC in the river. Applications of EEMs coupled with PARAFAC modeling identified 3 major fluorescent DOM components, all terrestrial humic-like components. Average DOC flux to Lake Michigan was estimated at 6.27×109 g-C/yr.

P-25: OPTICAL AND SIZE CHARACTERIZATION OF SOIL DISSOLVED ORGANIC MATTER

SHIMAA KTEEBA, Zhengzhen Zhou, Laodong Guo

S09: SS: Dynamics of Carbon

Soil organic matter is an important source for dissolved organic matter (DOM) in aquatic environments. However, composition, size, and degradation are less understood. Three soil samples were collected from northern Alaska, the Milwaukee River basin (MRB), and Gulf coastal saltmarsh. Soil DOM was extracted for measurements of bulk dissolved organic carbon, optical properties using UV- and 3-D fluorescence spectroscopy, and size spectra using flow field-flow fractionation, and for degradation.The Arctic soil contained higher leachable DOM compared to soils from the MRB and saltmarsh, with more terrestrial humic-like DOM component. Fluorescence EEM spectra showed three major DOM components: two humic-like (peaks A & C) and one protein-like (peak B), with more protein-like component in the MRB soil.Soil-DOM mainly partitioned in the <4nm size range with additional peaks in the 4-8nm and >20nm, containing mainly humic-like and protein-like components, respectively. DOM-compositions of each size fraction showed matching EEM characteristics.The saltmarsh sample contained more mid-sized (4-8 nm) protein-like DOM and larger sized (>20 nm) humic-like DOM.Results on the degradation of soil DOM will also be presented.

P-26: SIMULATING STREAM TEMPERATURE MODULATION OF BENTHIC NITRATE REMOVAL PATTERNS ACROSS STREAM NETWORKS

Sam Carlson, Geoffrey Poole, Robert O. Hall, Natalie Day, Ellen Wohl, Bridget Livers, Hilary Madinger

S09: SS: Dynamics of Carbon

Widespread anthropogenic alterations to stream networks include increasing nutrient loads and increasing stream temperatures. Previous work has shown reduced denitrification efficiency of streams with increased nitrate loading, but the potentially confounding effects of stream temperature have not been considered. We present a stream network denitrification model based on an empirical relationship between denitrification uptake velocity, nitrate concentrations, and respiration rates, with respiration rate governed by stream temperature. We apply this model to the upper North Saint Vrain basin in Rocky Mountain National Park, CO, with parameterizations to represent a range of temperatures and pre- and post-industrial rates of nitrate loading. The application of this model reveals the opposing effects of increased nitrate loading and temperature on network-scale patterns of nitrate removal efficiency.

P-27: RIVERPACE: RESULTS OF A NATIONAL SURVEY OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN US RIVERS AND STREAMS BY UNIVERSITY STUDENT GROUPS

Jesse Becker, Melody Bernot, Thomas Lauer

S09: SS: Dynamics of Carbon

We collaborated with 27 student groups from universities across the US to sample 42 sites for pharmaceuticals and personal care products (PPCPs) in river water and sediments. PPCPs were found in 93% of water samples and 56% of sediment samples. The most common compounds were carbamazepine, cotinine, sucralose, sulfamethoxazole, triclosan, and venlafaxine, all present in over 50% of samples. Sucralose was most common, found in 83% of samples at concentrations up to 12,000 ng/L. Triclosan was found in 50% of samples, at concentrations up to 6,800 ng/L. Most other compounds, when detected, were found at relatively low concentrations (below 1,000 ng/L). Sites with higher concentrations of PPCPs tended to have a greater number of compounds, with three sites having total PPCP concentrations of 12,000 ng/L - 28,000 ng/L and 17 - 18 detectable compounds. There was a gradient from sites with higher concentrations of cotinine, gemfibrozil, and norcodeine to sites with more azithromycin, desvenlafaxine, trimethoprim, and venlafaxine. This study further confirms the ubiquity of PPCP compounds in aquatic systems and the influence that urban areas have on downstream receiving waters.

P-28: IMPACTS OF EICHHORNIA CRASSIPES (MART.) SOLMS STRESS ON THE NUTRIENTS AND MICROCYSTIN RELEASE FROM MICROCYSTIS AERUGINOSA

Qing Zhou

S09: SS: Dynamics of Carbon

Eichhornia crassipes (Mart.) Solms is effective in assimilating nutrients from eutrophic waters. However, it is not clear whether E. crassipes has an adverse impact on the waters in which heavy blooms of Microcystis aeruginosa occur. The objective of this study was to understand the interactions of E. crassipes with toxigenic M. aeruginosa and the consequences on environmental safety. Our results from co-existence experiments indicated that the cell death of M. aeruginosa occurred at a quicker pace due to the presence of E. crassipes. Energy harvest and electron transfer processes in the photosystem of M. aeruginosa might be disturbed by E. crassipes due to its damage of phycocyanin and a change in the phycocyanin/allophycocyanin ratio. E. crassipes significantly inhibited the rise of ammonia nitrogen concentration in water and was more advantageous to the removal of total dissolved phosphorus released from M. aeruginosa. After this 12-day experiment, the level of extracellular microcystin-LR was significantly eliminated from 212.68±25.05 ?g?L-1 to 18.98±0.35 ?g?L-1 and the microcystin-LR production in M. aeruginosa was not stimulated by the influence of E. crassipes.

P-29: THE USE OF TRAITS IN CORRELATIVE MODELLING OF WHOLE BODY METAL CONCENTRATIONS IN AQUATIC MACROINVERTEBRATES

Dorothea Hug Peter, Emmanuel Castella, Vera Slaveykova

S10: SS: Quantifying Ecological Traits

Despite advances in the understanding of uptake and bioavailability, whole body concentrations of aquatic macroinvertebrates remain hard to predict from environmental conditions. In this study, field data was collected to develop a multiple regression model to predict metal accumulation in macroinvertebrates from concentrations in water and sediment. Traits allowed to adapt the model to multiple taxa: the affinity of the species for certain trait categories (i.e. gatherer collectors) were used as parametric terms within the model. The models for different metals (Ni, Cu, Pb, Zn, Cd, Al) were able to explain over 50% of the variance (adjusted R2).The significant parameters conveyed information on different uptake mechanisms. The significance and positive or negative coefficients of traits could be used to identify sensitive traits and taxa. Preliminary prediction trials showed that the influence of environmental conditions and of different types of taxa needs to be tested further to improve predictive power. Overall, the study confirmed that the adaptation of models to different species and environmental conditions remains challenging but that the use of traits is a promising approach.

P-30: INFLUENCE OF GROWING SEASON STREAM FLOWS ON PERIPHYTON GROWTH

David Diaz

S11: SS: Biotic Response to Flow

Water extractions for irrigation in the lower Flint River Basin (LFRB) can reduce summertime stream flows below historic levels, particularly during droughts. Anecdotal evidence suggests that these low-flow conditions promote periphyton growth. We conducted controlled experiments to examine how flow conditions affect summertime periphyton growth, biomass, and composition in Ichawaynochaway Creek, a tributary of the lower Flint River. Creek water was pumped through replicate artificial stream channels lined with tiles to achieve 5 discharge treatments ranging from 0.25 to 5 gpm. Tiles were collected bi-weekly for four weeks to quantify periphyton biomass and calculate growth rate. Noticeable growth occurred in all discharge treatments, but growth rates and final biomass increased with discharge. Flow also affected periphyton taxonomic composition as higher discharge promoted development of thick diatom mats and lower discharge were dominated by filamentous green algae. Additional experimentation (to be reported) examined the influence of nutrient and stream herbivores interaction responses to flow-related differences in periphyton growth and composition. These findings provide insight into how alterations to summertime flow regimes affect stream ecological conditions within the LFRB.

P-31: SIZE STRUCTURE AND DISTRIBUTION OF PREDATORY AQUATIC INSECTS AMONG MESOSCALE HYDRAULIC HABITATS

Summer Aldabbeh, Jessica Orlofske, Wendy Monk, Donald Baird

S11: SS: Biotic Response to Flow

This research examines how mesoscale streamflow dynamics can filter aquatic insect communities based on their trait expression. As water levels change seasonally, depth and velocity fluctuate temporally and spatially within the channel. Invertebrates select these mesoscale habitats based in part on their physiological requirements. Therefore, the environment is a strong selective force acting on organismal traits to determine site-level taxonomic composition. We use high-resolution habitat data including, depth, average and bed velocity, shear stress, and Froude number collected in conjunction with invertebrate sampling in the Miramichi River in New Brunswick, Canada in July and September 2010 to investigate flow-environment relationships for five orders of aquatic insects (Ephemeroptera, Plecoptera, Trichoptera, Odonata, and Megaloptera). Here, we focus on the distribution of predatory invertebrates and their potential to interact with other invertebrates within mesoscale habitats. Predators also demonstrate the greatest magnitude of growth, which was tracked over time. By mapping the movements and morphological characteristics of invertebrates, particularly predators, we can better understand their habitat requirements throughout development - a necessary component for establishing connections to larger-scale hydrologic processes and environmental flow regulations.

P-32: MORPHOLOGICAL CHARACTERIZATION OF EXUVIA FROM CO-EMERGING RIVERINE DRAGONFLIES USING GEOMETRIC MORPHOMETRICS

Valerie Riehl, Jessica Orlofske

S11: SS: Biotic Response to Flow

Among many evolutionary pressures, the physical environment plays a significant role in refining organism morphology. The purpose of this study is to determine whether geometric morphometrics can be used to differentiate or characterize shape variation among species and sexes of co-emerging riverine dragonflies, including two rare species in New Brunswick, Canada: Ophiogompus howei and Gomphus ventricosus. Exuvia from 26 locations along the St. John and Miramichi Rivers were collected in June 2013. Exuvia were identified to species, photographed, and landmarks were digitized on digital micrographs of the dorsal and ventral surfaces. A multivariate analysis of variance was used to test for differences in body shape between species and sexes within a species. We expect to find significant levels of variation among species in support of taxonomic diagnosis, but fewer differences between sexes within a species. A detailed analysis of shape will help to confirm the presence of rare and protected species at these sites. Furthermore, this analysis provides a necessary first step toward the examination of phenotypic variation of these species based on differences in habitat hydrology.

P-33: INVESTIGATING RELATIONSHIPS BETWEEN NATURAL FLOW REGIMES AND MACROINVERTEBRATE ASSEMBLAGES IN THE SUSQUEHANNA RIVER BASIN

Brianna Hutchison, Graham Markowitz

S11: SS: Biotic Response to Flow

In 2009, The Nature Conservancy, the Susquehanna River Basin Commission (SRBC), and the U.S. Army Corps of Engineers collaborated to identify ecosystem flow needs for the Susquehanna River and its tributaries. This collaboration resulted in a set of flow recommendations for maintaining the long-term hydrologic variability necessary to support ecological processes and biotic integrity of streams throughout the basin. These recommendations were derived from published literature and expert consultation rather than from novel quantitative analyses or field studies. SRBC established a flow monitoring network between 2010 and 2012 with the goal of verifying proposed hydrology-ecology relationships. The current network consists of 19 stations in Pennsylvania and New York and focuses on minimally disturbed streams in order to isolate ecological responses from anthropogenic impacts. Data from the five stations monitored from 2010 to 2014 were used to quantify relationships between flow regime and macroinvertebrate community composition. The results of this study will be used to advise SRBC management decisions regarding mitigation of consumptive water use and establishment of passby flows for surface water withdrawals in the Susquehanna River basin.

P-34: PRESENCE OF THE INVASIVE NUISANCE DIATOM DIDYMOSPHENIA GEMINATA IN RIVERS OF TIERRA DEL FUEGO ISLAND, SOUTHERN CHILE

maximo frangopulos, marco pinto, Carolina Diaz, Sebastian Ruiz, Guillermo Alvarado, Rodrigo Torres

S13: SS: Didymosphenia germinata

Didymosphenia geminata is an invasive diatom, capable of producing large algal blooms, which cover the benthic substrate of freshwater environments. The first positive identification of Didymo in Chile was reported in 2010 in the Futaleufú and Espolón rivers, about 1700 km north of the Magellan region. Here we reported the first record of Didymo in Magellan region, specifically on Tierra del Fuego Island, Chile (53°53'35.21"S, 68°52'55.42"W). The study area comprised 73 freshwater sources within the Magellan region (53-56°S), which were classified according their anthropic use: fishing, kayaking, trekking, etc. The results obtained showed the presence of Didymo in two rivers of Tierra del Fuego (Grande and Blanco), covering an area of approximately 58 km of river affected continuously with positive samples of Didymo. The survey of rivers and lakes, established that most of the rivers in the Magellan region constitute an ideal environment for the settlement of Didymo, so the eventual spread of the microalgae is imminent, if the prevention and biosecurity measures are not considered. This is the southernmost record of Didymo and the only record from Chile.

P-35: EFFECTS OF PH ON DIDYMOSPHENIA GEMINATA DISTRIBUTION, METABOLISM, AND PHOSPHORUS UPTAKE

Lucas Hix, Justin Murdock

S13: SS: Didymosphenia germinata

Didymosphenia geminata is a nuisance diatom that is often most abundant in a neutral to slightly basic pH (~7-8.8). Surveys in the upper Tennessee River watershed indicated that D. geminata abundance was best correlated with stream pH. Maximum cell abundance was found at a pH of 8.03, and no cells were found in streams with a pH below 6.2. We investigated how pH effects mat function to better link pH and D. geminata distribution. We incubated D. geminata mats in pH treatment of 5.1, 6.1, 7.1, and 8.1 for 6 d in 10 L recirculating chambers and measured mat metabolism, phosphorus uptake, and cell survival at the end of the incubation. Gross primary productivity consistently increased with increasing pH and was 38% greater at 8.1 than 5.1. Mat respiration did not differ among treatments. Phosphorus uptake was greatest at pH 7.1. This was ~16% greater than the other treatments which did not differ from one another. Chronic acid deposition has occurred in Southern Appalachian watersheds, and this deposition may be regulating D. geminata distribution and function in this region.

P-36: INFLUENCE OF DIDYMOSPHENIA GEMINATA MATS ON STREAM METABOLISM AND NUTRIENT CYCLING

Jaime Haueter, Lisa Kunza

S13: SS: Didymosphenia germinata

Didymosphenia geminata can produce copious amounts of stalk material creating thick benthic mats that may alter stream processes and function. Although many researchers are investigating controls on D. geminata and its distribution, the effects of D. geminata mats on stream ecosystem functions remain unclear. Our objectives were to compare D. geminata mat influence on metabolism and nutrient cycling in three lake outlets in Grand Teton National Park, WY. Lake Creek had thick mats covering >70% of substrate, Taggert Creek had patchy mat development, and Bradley Creek had no mat presence. Although mats may increase respiration, the photosynthesis of the epiphytic algae in the mat matrix may also increase leading to altered P/R ratios. Nitrogen fluxes, including nitrogen fixation and denitrification, can increase with D. geminata mat presence. D. geminata mats in Lake Creek removed an average of 68% of P added to chambers, which is 3 times more P uptake than Bradley Creek during 4 h incubations. Quantifying how D. geminata mats alter stream processes is important for understanding the ecological and economic impacts of mats.

P-37: HISTORICAL ABUNDANCE OF DIDYMOSPHENIA GEMINATA IN GRAND TETON NATIONAL PARK, WYOMING

Christopher Schiller, Jaime Haueter, Lisa Kunza, Sarah Spaulding

S13: SS: Didymosphenia germinata

Didymosphenia geminata, a freshwater diatom, produces thick nuisance mats in oligotrophic streams. While considered native to boreal North America, the historical distribution of D. geminata has not been established, beyond literature observations. To investigate historical abundance, we examined cores dating to approximately 150 years BP from three sites in Grand Teton National Park: Phelps Lake, Bradley Lake, and the oxbow bend of the Snake River. The outlet of Phelps Lake, Lake Creek, has contained annual mats of D. geminata up to 4 cm thick since the early 2000s. In contrast, Bradley Lake outlet and the oxbow bend lack documented occurrence of D. geminata. In addition to D. geminata, we recorded the incidence of sister taxa, Cymbella mexicana and Cymbella janischii, and also Asterionella formosa, an indicator of increased atmospheric nitrogen deposition. D. geminata valves were rare in recent Phelps Lake sediments, while C. mexicana proved abundant. We demonstrate that paleolimnological methods may expand the historical distribution of D. geminata. These results will contribute to correctly interpreting natural versus introduced (or invasive) distributions that are relevant to management of aquatic resources.

P-38: THE INFLUENCE OF D. GEMINATA ON BENTHIC MACROINVERTEBRATE RESOURCE AVAILABILITY IN RAPID CREEK, SOUTH DAKOTA

Russell Marlow, Lisa Kunza

S13: SS: Didymosphenia germinata

Benthic macroinvertebrates (BMI) are structured to process the resources present in fluvial ecosystems and can alter their foraging strategies dependent upon stress and availability of resources. Didymosphenia geminata, a nuisance freshwater diatom, forms mats of extracellular stalk material that can blanket stream/river substrates. In 2014, D. geminatamats in Rapid Creek, SD at times covered 80+% of the stream substrate with mat thickness up to 3.5cm. Ultimately, D. geminata mats alter resource composition and availability for the BMI community. We examined BMI diet composition and resource availability shift in relation to the presence and growth of D. geminata mats. With variable D. geminata mat thickness and patchiness depending upon season and location in Rapid Creek, we structured our experimental design to examine seasonal and longitudinal trends. Our objectives were to examine the influence of D. geminata on the quantity and availability of benthic resources and BMI diet selection. Due to flows 5 times the average daily discharge, flow regime altered D. geminata mat thickness throughout 2014 and lead to an observable decrease in BMI abundance and resource availability.

P-39: COUPLING FRESHWATER MUSSEL ECOLOGY AND RIVER DYNAMICS USING A SIMPLIFIED DYNAMIC INTERACTION MODEL

Amy Hansen, Jonathon Czuba, Jon Schwenk, Anthony Longjas, Mohammad Danesh-Yazdi, Daniel Hornbach, Efi Foufoula-Georgiou

S15: SS: Deconstructing Cumulative Effects

To better understand freshwater mussel population dynamics as a watershed scale, we developed a long term, dynamic, process-based interaction model coupling streamflow, suspended sediment, phytoplankton, and mussel abundance under the hypothesis that chronic exposure to increased suspended sediment and food limitation, both driven by streamflow, are the primary factors controlling native mussel population density in a Midwestern U.S. agricultural river basin. The model was calibrated and validated with extensive mussel survey data from multiple time periods and used to evaluate changes in mussel abundance at a sub-basin scale over decades. Sensitivity of simulated mussel densities was evaluated across a range of mussel mortality rates and initial mussel population densities. Scenarios representing potential changes in sediment concentrations, as might occur with climate or land use induced changes in streamflow or sediment generation rates, showed critical thresholds in suspended sediment concentrations which bracket a dynamic response in mussel population density. This biophysical process-based approach to modeling mussel population dynamics facilitates identification of mussel population limiting factors and priority locations for restoration activities.

P-40: MINI-BIOBLITZ EVENTS HELP ?BRIDGE THE GAP? FOR BIODIVERSITY AT GEORGE WASHINGTON CARVER NATIONAL MONUMENT, MISSOURI AND BUFFALO NATIONAL RIVER, ARKANSAS

Janice A. Hinsey, Theresa M. Johnson

S16: SS: Public Participation in Freshwater Research

HTLN established baseline inventories of important indicators of ecosystem health, or ‘vital signs’ for all its network parks. Long-term monitoring of these ‘vital signs’ are used by park managers to make good, science-based decisions in managing natural resources. BioBlitz events involve professional scientists, students, and citizen scientists working together to find and identify as many different taxa as possible using scientific methods. They provide taxa level information not easily obtained during routine monitoring. BioBlitz events help bridge the gap. In addition, students are provided career based networking opportunities with professional scientists. Historically, NPS has focused on ‘all taxa’ BioBlitz events that involved long term planning, major funding, and substantial park and volunteer participation. A much simpler one-day event was conducted at George Washington Carver National Monument, Missouri (2013, 2014) and Buffalo National River, Arkansas (2014) that focused on six taxa groups. This event resulted in the identification of 143 taxa never before documented in the parks. Conducting multiple smaller mini-BioBlitz events may be just as effective as a large one-time event.

P-41: ANTHROPOGENIC LITTER DENSITY ON LAKE MICHIGAN BEACHES: ROLE OF RIVER MOUTH PROXIMITY AND FISHING ACTIVITY AS REVEALED BY CITIZEN SCIENCE DATA COLLECTION

Meagan Westhoven, Timothy Hoellein, Jamie Cross, Olga Lyandres

S16: SS: Public Participation in Freshwater Research

The abundance and distribution of anthropogenic litter (i.e., garbage; AL) is well studied in oceans, but freshwater research lags behind. Marine studies have used data from volunteer beach clean-ups to quantify AL density and infer sources, such as inputs from rivers and fishing. We analyzed data collected by volunteers in the Alliance for the Great Lakes Adopt-A-BeachTM program on AL density and composition at 214 Lake Michigan beaches (N = 49,718 volunteers; 2,953,479 AL items; 3,804 data sets). First, we categorized AL by use (e.g., smoking-, food-, and fishing-related) to infer the major sources across beaches. Next, sites were categorized by distances from river mouths (?0.5 km, 0.5-1 km, 1-4 km, and >5 km) to determine potential riverine AL sources. Finally, beaches were categorized by shore-fishing activity (i.e., high and low) based off of the states' Department of Natural Resources data. We compare absolute and relative abundance of fishing-related AL to well-studied marine beaches. Results from the ongoing analyses will guide refinement of protocols directed at efficient AL clean-ups and prevention on beaches in the Great Lakes and elsewhere.

P-42: EFFECTS OF RESTORED RIPARIAN BUFFER LENGTH ON MACROINVERTEBRATES IN RANGELAND STREAMS

Bronwen Stanford

S17: SS: Landscape Approaches to Nutrient and Sediment Management in Streams

In agricultural landscapes, riparian woody revegetation can provide benefits including trapping fine sediment, providing shade and leaf litter, increasing habitat complexity, and slowing flows. However, the benefits from these reach-scale restoration projects are variable, likely due to variations in both site characteristics and restoration design. Riparian buffer width and position are known to affect macroinvertebrate communities and instream conditions, but less is known about the impact of buffer length. Greater continuous lengths of woody riparian vegetation should result in an increase in macroinvertebrate collector-gatherers and shredders and decrease in scrapers, while substrate should become more coarse. I present preliminary results evaluating the effect of buffer length on instream conditions in the mediterranean-climate rangelands of west Marin, California. I compare physical habitat and macroinvertebrate communities at sites along a gradient of upstream buffer lengths to determine whether there is a positive cumulative effect of multiple reach-scale restoration projects in these landscapes. Information about the impact of buffer position and length will help managers better place restoration projects.

P-43: QUANTIFYING DENITRIFICATION RATES AS A FUNCTION OF NITRATE AVAILABILITY IN VEGETATED AGRICULTURAL DITCHES

Shannon Speir, Thad Scott, Jason Taylor

S17: SS: Landscape Approaches to Nutrient and Sediment Management in Streams

Application of external nitrogen (N) inputs to agricultural systems has increased food production to meet growing demands worldwide. However, excess N inputs also contribute to significant environmental impacts including eutrophication of fresh and coastal waters. Widespread implementation of best management practices (BMP) that reduce N inputs to aquatic ecosystems are needed. Denitrification is a biologically-mediated removal mechanism that decreases nitrate transport to downstream waterbodies. Recent work demonstrated that ditch sediments planted with Leersia oryzoides have significantly higher denitrification potential than bare sediments or those planted with Typha latifolia. Other factors including temperature, oxygen concentrations, nitrate availability, and organic matter content also influence denitrification rates. In this study, we explored the effects of nitrate availability on denitrification in agricultural ditch sediments vegetated with L. oryzoides. Denitrification rates were measured as N2 production from intact vegetated sediment cores using Membrane Inlet Mass Spectrometry. We will present denitrification rates and efficiency as a function of nitrate concentration in experimental cores using Michaelis-Menten kinetics. This study will contribute to the development of future models that predict denitrification rates associated with vegetated ditch BMPs.

P-44: WHEN IS ENOUGH, ENOUGH? EXPLORING POTENTIAL CONSERVATION THRESHOLDS IN AN AGRICULTURAL WATERSHED.

Anna Kottkamp, Brittany Hanrahan, Jennifer L. Tank

S17: SS: Landscape Approaches to Nutrient and Sediment Management in Streams

We are quantifying the water quality benefits of the watershed-scale implementation of winter cover crops (e.g., ryegrass) planted after cash-crop harvest (i.e., corn/soybeans). Our goal is to determine how relative cover crop coverage influences stream nutrient export in the Shatto Ditch Watershed (SDW, Kosciusko Co., IN). As part of a larger study, after cover crop planting in Fall 2013, we collected water samples and measured discharge every 14d for one year at 10 longitudinally-distributed sites along 8 km of stream. Using GIS and the site-specific drainage area estimated from our longitudinal sampling sites, we identified nested sub-watersheds (size range= 60-880 acres) within the larger 3000-acre SDW. We then calculated the total acreage and percent cover crop coverage (range=10-90%) in each sub-watershed, and explored the relationship between stream nutrient yields and cover crop coverage. We found that average daily N yield (kg NO3-N/acre/day) decreased as percent cover crop increased. These results suggest a direct relationship between landscape cover crops and improved water quality in agricultural watersheds, at small to large spatial scales, which will be useful in developing targeted conservation planning.

P-45: MODELING REFERENCE NUTRIENT CONDITIONS WITH QUANTILE REGRESSION EXTRAPOLATION

Benjamin Jessup, Joshua Schultz

S17: SS: Landscape Approaches to Nutrient and Sediment Management in Streams

Idaho streams generally endure low levels of disturbance in their catchments, especially in mountainous terrain where agricultural activities and urban development are sparse. However, streams in the plains, plateaus, and broad valleys (PPBV) are different than the mountainous sites in both natural and disturbance characteristics. They are generally lower gradient, warmer, and subject to drier climatic conditions. These flatter areas are also more suitable to human activities resulting in higher rates of disturbance with respect to nutrients and nutrient-sensitive ecosystems. Reference sites in the PPBV are the best available sites and have greater intensities of stressors compared to the set of mountainous reference sites. We used frequency distributions of nutrient concentrations in reference sites to characterize reference nutrient conditions. In the mountains, the best reference conditions were observable as the 75th quantile of reference site data. In the PPBV, we extrapolated the 75th quantile to the expected, but not observed, best reference conditions using quantile regression along a gradient of urban and agricultural land uses. This technique allows refinement of reference expectations for nutrients in areas with ubiquitous development.

P-46: HIGH-FREQUENCY NITRATE MONITORING TO QUANTIFY UNCERTAINTIES OF SAMPLING STRATEGIES IN AGRICULTURAL WATERSHEDS

Kaycee Reynolds, Terrance Loecke, Amy Burgin, Caroline Davis, Diego Riveros-Iregui, Steven Thomas, Martin St. Clair, Adam Ward

S17: SS: Landscape Approaches to Nutrient and Sediment Management in Streams

Understanding highly dynamic processes such as nitrate (NO3-) loading to agricultural streams requires optimization of monitoring strategies. The expansion of a spatially distributed, high-frequency water quality monitoring network covering ~40% of Iowa (USA), provides direct observations of in situ NO3- concentrations at a 15-minute resolution. Systematic subsampling of this NO3- record allows quantification of uncertainty in concentration and load estimations for conventional sampling regimes and frequencies. Using this data, we asked: What is the optimal sampling regime/frequency to sufficiently characterize NO3- concentration and load estimations? Furthermore, are watershed characteristics (e.g. size or flashiness) predictors of optimal monitoring strategies? We subsampled records for 47 site-year combinations for three sampling regimes: completely random, discrete time-interval and flow-induced (i.e. event-based/storm-chasing). Daily sampling frequency is optimal based on uncertainty alone; however, for most systems and monitoring campaigns this is not an economically viable option. The time-interval sampling regime provides the most reliable annual mean NO3- concentration estimation regardless of frequency, while even infrequent storm-chasing (i.e. flow-induced sampling) sufficiently characterized NO3- loads. High-frequency NO3- records allow reliable evaluation of concentration and flux uncertainties promoting future optimization of sampling strategy based on monitoring objectives.

P-47: INSECT MORPHOLOGY REFLECTS ENVIRONMENTAL VARIABILITY IN TROPICAL LOWLAND STREAMS, COSTA RICA

Pablo E. Gutierrez-Fonseca, Alonso Ramírez

S18: SS: Stream macroinvertebrate response to disturbances in Neotropical streams: recent advances and future directions

Environmental variability has been shown to cause alterations on macroinvertebrate morphology. Organisms might reflect stress conditions by changes on structural shape (i.e., symmetry) and body size. We assessed fluctuations in insect morphology: directional asymmetry (DA), antisymmetry, fluctuating asymmetry (FA) and body size, and their relation to environmental fluctuations (e.g., discharge, changes in pH). Ephemeroptera adults were collected weekly for 3y (2001-2003) with emergence traps. Environmental variables were measured and related to morphological changes. Nine traits were measured. Differences between the measurements of the right and left side were used on data analyses. The results showed no evidence of DA and antisymmetry on mayfly characters. In addition, there were no significant differences in the interaction between Side and Individual, indicating a lack of FA. However, differences among individuals were significant, suggesting patterns related to size. Trait size was correlated to body size, which was associated to several environmental variables. Our results suggest that changes in size are the strategy to face stress conditions rather that FA. Small sized individuals were associated with periods of environmental adverse conditions.

P-48: EPHEMERAL POND HYDROLOGIC CHARACTERISTICS EFFECTS ON PEAT ACCUMULATION

Anna Winfield

S20: SS: Temporary Wetlands

The purpose of this study is to determine relationships between peat depth and wetland hydrologic characteristics in ephemeral ponds. These ponds provide habitat for many different plant species, which shed organic matter that accumulates as peat. In addition, surrounding forests contribute substantial leaf litter. There may be a feedback loop between peat depth and hydroperiod that is important because peat provides nutrients for plant and animal species as well as stabilizes hydroperiod. Data on peat depth and hydrologic characteristics were collected in 39 ephemeral ponds in Chippewa County, Wisconsin. We also measured seasonal water depth range, mean water depth, and standard deviation to capture hydrologic variability. We hypothesized that increased hydroperiod and mean water depth will lead to increased peat accumulation, while increased range and standard deviation will decrease peat accumulation. Peat accumulation varies in small and large ephemeral ponds, with small ponds dependent upon water depth and large ponds dependent upon sedge and Sphagnum formation. Increased peat accumulation may cause longer hydroperiods due to its impermeability – creating a positive feedback loop.

P-49: SEASONAL TRENDS IN WATER CHEMISTRY IN THE PERMANENT AND EPHEMERAL WETLANDS OF WISCONSIN?S CHIPPEWA MORAINE

Pamela Gehant, Amanda Little, James Church

S20: SS: Temporary Wetlands

We investigated seasonal differences in pH, conductivity, and dissolved oxygen concentrations between permanent and ephemeral wetlands within the Chippewa Moraine region of Wisconsin. We used general linear models to compare the effects of wetland type (ephemeral vs. permanent) and sample period (nested within wetland type) on the water chemistry attributes. Specific conductivity was significantly higher in ephemeral wetlands than permanent wetlands, with no significant change over the growing season. Dissolved oxygen was significantly higher in permanent wetlands, but significantly decreased between sample periods. There was no significant difference in pH between permanent and ephemeral wetlands, but pH showed significant fluctuation between sample periods. Similar fluctuations were observed between the two types of wetlands over time. Ephemeral wetlands exhibited a higher specific conductivity and temperature which is likely due to their small size. pH fluctuations between sample periods may be affected by vegetation or soil conditions. The hydroperiod of a wetland seems to be an important factor affecting water chemical characteristics. Our findings provide a framework for investigating relationships between water chemistry and biological communities.

P-50: THE EFFECT OF HYDROPERIOD ON FALL ZOOPLANKTON ABUNDANCE IN SMALL FLOODPLAIN PONDS (BLACK FORK OF THE MOHICAN RIVER, OH)

Patricia Saunders, Rosalie Sepesy, Olivia Macek

S20: SS: Temporary Wetlands

Typically, permanent floodplain ponds show year-round water retention and temporary ponds show seasonal drying and filling. We previously found fall zooplankton abundance in a permanent pond was relatively high and consistent across years (101-121 L^-1). In a temporary pond, it was more variable between years (77 vs. 16 L^-1 for dry summer/wet fall vs. wet summer/wet fall). Therefore, seasonal drying followed by significant flooding linked to stronger zooplankton population growth in temporary ponds; there are alternative hypotheses for how this may work. We measured habitat qualities, quantified common zooplankton, and obtained precipitation and water-level data. For this study, we compared several ponds and included a year with a dry summer/dry fall (i.e. all ponds dried, then refilled gradually Oct-Dec). Zooplankton abundance in rewetted permanent ponds was ca. 20% of abundance in wet autumns. In rewetted temporary ponds, zooplankton were abundant (111 L^-1), consistent with the greater accumulation observed in a previous year with a dry phase. Overall pond diversity and among-year differences in zooplankton dynamics within each pond relate to differences in consumer success and species richness in this landscape.

P-51: WATER QUALITY ASSESSMENT OF RIVER NARMADA USING BENTHIC MACROINVERTEBRATES

SHAILENDRA SHARMA, Rupali Mandloi,, Shitika Barkale,

SS:Asian Freshwater Futures

The Narmada river of Khargon district at Mandleshwar in Madhya Pradesh was chosen to assess the impact of alteration of the flow regime on water quality, due to the formation of the dame. The sites were chosen at Pre-commissioning and post-commissioning stage of the Maheshwar Dame .The present study involved sampling, pre-identification and identification of macro-invertebrates and computing the % occurrence of families of various taxonomic groups and conducting physico-chemical analysis of samples from selected location. Macro-invertebrates chosen were identified up to family level, and bio assessment at various locations has been done using NEPBIOS score system. It was found that out of total 39 genus belonging to 12 families of taxonomical group like Ephemeroptera, Trichoptera, Plecoptera, Coleoptera, Heteroptera, Odonata, Diptera Mollusca, Oligochaetes etc.have been found in different composition inhabiting the river. The results further show that all the locations assessed for quality using macro-invertebrates and physico-chemical analysis are in the range of water quality class II(Good)during Pre-Commissioning stage of the Maheshwar dame,while during post-commissioning stage of theMaheshwar ,the water quality class is III (Moderately Polluted) .

P-52: THE CASPIAN CRAYFISH AS A MARKER OF WATER CONTAMINATION IN THE KAZAKHSTANIAN AREA OF OIL PRODUCTION

Z. M. Biyasheva, N. A. Ibragimova , R. B. Esenov

SS:Asian Freshwater Futures

The necessity of environment regular monitoring is a permanent change of its quality. It is necessary to organize a number of nature protection events in the area of increasing technogenic loading on ecosystems. The aim of the present research is realizing the macroscopic and morphometric study of the Caspian crayfish (?stacus caspius Rathke 1837) under the conditions of Aktau, the most important port for oil transportation of Kazakhstan. Twenty-five crayfish were collected and defined the morformetric indexes according to standard methodologies in August. There were 22 females and 3 males in the aggregation that conforms with literature data on the predominance of females in autumn. The reliable distinctions had been found for some morphometric parameters: their common length, length and width of cephalothorax and rostrum. All the caught crayfish were two years old and infected by septocelendroze. It may be the cause of organ regeneration delay and their underdeveloped. It is revealed in morphological ugliness and their body asymmetry. When doing microscopic research of gepatopancreas the structural changes of all cell types: F, B and K can be found.

P-53: FOOD WEB COMPLEXITY STABILIZES SEASONAL VARIABILITY IN RIVER?TERRESTRIAL LINKAGES

Akira Terui, Takumi Akasaka, Junjiro Negishi, Fumihiko Uemura, Futoshi Nakamura

T01: Food Webs

Aquatic–terrestrial trophic linkages play a role in transporting materials from rivers to adjacent ecosystems. Although the trophic links have often been conceived as static and depicted as a single pathway, there are a variety of links containing seasonal variations. We investigated how donor prey (aquatic insects) and recipient consumer diversity (ground beetles) interact to stabilize seasonal variability of the material flow from rivers to adjacent gravel bars. Surveys were conducted in the Tottabetsu River, Hokkaido, Japan. Based on CN isotopic information and biomass of each consumer species, we estimated how material flow through aquatic insect–ground beetle links has changed over time (June to October). The seasonal variability of material flow mediated by individual trophic links (measured as CV) was high, and each had its own seasonal peak. However, they changed in a compensatory way and greatly stabilized the summed material flow at the community level. This suggests the importance of temporarily-resolved perspective on food webs.

P-54: THE FOOD WEB OF A TROPICAL ISLAND STREAM

Keysa Rosas, Checo Colon-Gaud, Alonso Ramírez, Tavis Anderson

T01: Food Webs

Quantitative food webs describe the connectivity between consumers and resources, but also combine diet analyses with taxon-specific production estimates to determine energy flow between species. The resulting web tells us how much each food source is responsible for the production of each species and their trophic position. In this study we estimate annual secondary production and develop a quantitative food web of the benthic insect communities present in two small streams at the Luquillo Experimental Forest (LEF), Puerto Rico. We examined the gut content of the dominant aquatic insect groups: Leptophlebiidae and Baetidae mayflies, Calamoceratidae and Hydropsychidae caddisflies and Chironomidae midges and found that these groups rely heavily on plant tissue and amorphous detritus. Overall, aquatic insects in the LEF have low biomass; therefore, their production is relatively low compared with available estimates. Secondary production appears to rely more on allochthonous organic matter, rather than primary production. This study is one of the first to quantify the production and food web of the benthic insect community in tropical island streams.

P-55: LARGE WOOD ENHANCES RESOURCE AVAILABILITY IN A LOWLAND RIVER AS DEMONSTRATED BY COMBINED STABLE ISOTOPE AND FATTY ACID ANALYSES

Matthew Cashman, Francesca Pilotto, Gemma Harvey, Geraldene Wharton, Martin Pusch

T01: Food Webs

We examined whether large wood (LW) may influence the availability and quality of trophic resources for benthic macroinvertebrates in a lowland sand-bed river. Samples were collected from LW, surrounding sediment, and control sediments away from LW. Diets were estimated through stable isotope (SIA) and fatty acid (FA) biomarkers. The three locations had distinct macroinvertebrate communities, and abundance and taxa richness were greatest in wood locations. SIA suggested all communities were largely supported by seston from a nearby lake, and in wood locations, also by the phytobenthos. FA did not directly detect seston, but instead differentiated between allochthonous and autochthonous origins. Autochthonous resources contained the highest concentrations of polyunsaturated FA, and macroinvertebrate profiles were enriched in polyunsaturated FA in wood locations. The joint use of SIA and FA in this study was complementary, particularly for addressing the mix of lacustrine and riverine resources. Our study suggests that the availability of LW may alter the diversity and biomass of the macroinvertebrate community by increasing the diversity and quality of available food resources, primarily through increasing autochthonous phytobenthos production directly on wood substrates.

P-56: RESILIENCE OF AQUATIC COMMUNITIES IN NATURALLY FISHLESS LAKES IN YELLOWSTONE NATIONAL PARK TO FISH STOCKING

Victoria Chraibi, Sherilyn Fritz

T01: Food Webs

For nearly 100 years, many of the naturally fishless lakes in Yellowstone National Park were stocked with six species of fish. Sixty years after the fish-stocking program ended, some lakes have returned to a fishless state, while other lakes continue to maintain fish populations. The purpose of this study is to use a paleoecological approach to evaluate how and why these lakes responded differently to fish stocking through time. Using fossil diatom, zooplankton, and invertebrate assemblages and historical records of fish stocking, we are reconstructing the food web of each lake before, during, and after fish stocking to examine how the introduction of new predatory species affected the trophic structure. The lakes in this study are grouped into paired replicates, including control lakes that were never stocked, to evaluate how abiotic characteristics, such as lake morphology, bedrock, and regional microclimate, influence the resilience of the biotic community. The reconstructed time series of ecological change are being viewed within the context of resilience theory, defined as the ability of a system to buffer disturbances without significantly changing structure and function.

P-57: CORBICULA FLUMINEA FOOD WEB ECOLOGY: AN EXPERIMENTAL TRANSPLANT APPROACH IN A KARST RIVERINE SYSTEM

Autumn Smith, Scott Grubbs, Albert Meier

T01: Food Webs

The Asiatic clam Corbicula fluminea is a filter-feeding habitat generalist. Carbon isotopic composition (?13C) of C. fluminea body tissue was compared between reaches of Kentucky's Green River that differ in Cladophora proliferation. Corbicula fluminea from an upstream reach with little Cladophora was translocated to a downstream reach with high Cladophora levels. Individuals from both reaches were placed in mussel silos in the same downstream reach in autumn 2012 and again in 2013 for 77 and 119 days, respectively. Flow during 2012 consisted of no high flow events until late autumn. Flow patterns in 2013 were consistently higher and more variable. In 2012 the upstream C. fluminea were 13C-depleted over time compared to no temporal change in the downstream C. fluminea. The trend was opposite in 2013. Upstream C. fluminea were more 13C-enriched over time whereas, again, there was no temporal change in the downstream C. fluminea. Estimated dietary contributions of basal resources using IsoSource found between-year trends that suggested that Cladophora fragments may represent an important food component during years with low flows and dense macroalgal growth.

P-58: TROPHIC DYNAMICS IN AGRICULTURAL STREAMS: LONGITUDINAL AND TEMPORAL PATTERNS IN ISOTOPE RATIOS OF BENTHIC MACROINVERTEBRATES FROM THE MINNESOTA RIVER BASIN, USA

Christy Dolph, Amy Hansen, Jacques Finlay

T01: Food Webs

Longitudinal trends in food web dynamics, such as those described by the River Continuum Concept, represent a foundational concept in stream and river ecology. While stream food webs have been studied extensively in forested systems, less is known about the trophic structure of open-canopy or agricultural stream communities. Agricultural activities may affect stream food webs in various ways, by altering riparian habitat conditions and nutrient, sediment and flow regimes. Here, we use carbon and nitrogen stable isotopes to describe variability in the trophic structure of benthic macroinvertebrate communities collected over time from a stream network in an intensively managed agricultural setting (the Minnesota River Basin, USA). In particular, we identify the importance of autochthonous vs allochthonous sources of organic matter to the diets of different functional feeding groups and specific macroinvertebrate taxa at five study sites ranging from small open-canopy drainage ditches to mid-size forested river sites. These sites exhibit differences in suspended sediments, light availability and riparian vegetation, all of which may affect the availability of food resources and consequent macroinvertebrate trophic structure.

P-59: TEMPERATURE DEPENDENCE OF LEAF LITTER BREAKDOWN IN NINE HEADWATER STREAMS LOCATED ALONG A REGIONAL THERMAL GRADIENT

Oliver J Wilmot, Jonathan P Benstead, Alexander D Huryn

T01: Food Webs

Leaf litter forms the base of foodwebs in low-order forest streams, which tend to be characterized by relatively low mean temperatures. Climate change may impact detrital carbon processing in these ecosystems, but the temperature dependence of litter breakdown is not well constrained. Moreover, relative responses of microbe- and invertebrate-mediated breakdown of particulate detritus are poorly understood. Warming of streams may not alter absolute rates of litter breakdown, but could cause shifts towards relative importance of microbial decomposition, altering carbon pathways. We incubated fine-mesh (microbe-mediated breakdown) and coarse-mesh litterbags (microbe+invertebrate-mediated breakdown) for ~1-month increments over a 1-year period in 9 headwater streams located along a natural temperature gradient from north Georgia to central Alabama, U.S.A. The temperature dependence of breakdown rates in both mesh sizes deviated from expectations based on the metabolic theory of ecology. Specifically, the “activation energy” of litter breakdown was 0.27 eV (95% confidence interval 0.22-0.33 eV) for fine-mesh breakdown and 0.25 ev (0.11-0.39 eV) for coarse-mesh breakdown, suggesting that other factors (e.g., nutrient limitation) can constrain the temperature dependence of litter breakdown in temperate forest streams.

P-60: A NOVEL METHOD FOR RAPID MEASUREMENT OF AMMONIUM ISOTOPE RATIOS WITH TIME-OF-FLIGHT MASS SPECTROSOPY

Denise Bruesewitz, Whitney King, Brenda Fekekete, Rebecca Chmiel, Emma Berger, Rebecca Forgrave, Dylan Plaskon, Timothy Hoellein, Chester Zarnoch

T02: Biogeochemistry

The use of 15-nitrogen (N) stable isotope tracers is a valuable tool for understanding N cycling in aquatic ecosystems, and experimental techniques using 15-N tracers range from mesocosms to stream reaches. Analytical measurement of 14-N:15-N ratios has traditionally involved incubations to concentrate N onto filters for analysis by isotope-ratio mass spectrometry. This process is time-consuming and often requires large sample volumes, a challenge for mesocosm experiments. Here, we present a technique for measuring 14-N:15-N in ammonium using ESI-TOF mass spectrometry. Small volumes of sample (<10 ml) are complexed with phenol using the Bertheiot reaction producing the traditional indophenol blue complex (mass 198 AMU). Excess reagents are removed and the indophenol concentrated using automated C18 solid phase extraction. The extracts are run through a spectrometer to measure total NH4+ concentration and passed to the ESI-TOF to obtain the 14-N:15-N ratio. We have successfully produced standard curves of 14-N:15-N as low as 5 ?M N. We will illustrate the method utility to calculate N transformation rates including uptake, regeneration and dissimilatory nitrate reduction to ammonium in lake, river and estuarine ecosystems.

P-61: EXAMINING METHANE PROCESSES AND METHANE DERIVED CARBON IN FOOD WEBS IN NORTH CAROLINA PIEDMONT STREAMS

Joshua Brigham, Anne Hershey, Martin Tsui

T02: Biogeochemistry

Methanogens utilize reactants found in organic matter to produce methane through a process called methanogenesis. Methane can be utilized by methane oxidizing bacteria to support their metabolism. When methane oxidizers are consumed by a higher trophic level, methane-derived carbon can be routed into the food web. The purpose of this study was to explore methane cycling and food web dynamics in Piedmont streams within or near Greensboro, North Carolina. Twelve Piedmont streams of varying land uses were sampled during baseflow in the summer of 2014. Representative invertebrate consumers, surface sediment, seston, and water samples were collected for methane concentration and stable carbon isotope analysis. Preliminary data demonstrated that pore water had significantly higher methane concentration and significantly lower methane del 13C values than surface water. Furthermore, del 13C of invertebrate consumers strongly suggested that Corbicula fluminea (Asian clam), but not hydropsychid caddisflies, were utilizing methane derived carbon as part of their diet, with Corbicula possessing del 13C values significantly lower than that of sediment or seston. This is most likely a result of differences in their feeding behaviors.

P-62: DIRECT AND INDIRECT EFFECTS OF SALINITY ON AQUATIC METABOLISM IN A NORTH CAROLINA COASTAL WETLAND

Tori Goehrig, Eva Gallardo, Marcelo Ardon-Sayao

T02: Biogeochemistry

Global climate and local land use change are causing increases of high salinity waters to former freshwater wetlands. While it is well known that salinity directly hinders plant productivity, the indirect effects of salinity on aquatic metabolism have not received as much attention. Salinity could indirectly affect metabolism by increasing light penetration through increased flocculation of dissolved organic matter. Here we examined direct and indirect effects of salinity on aquatic metabolism in a coastal wetland. We estimated aquatic metabolism using three years of continuous dissolved oxygen measurements and conducted laboratory assays to estimate flocculation and changes in light attenuation. Analyses are still underway, but preliminary results show that gross primary production is low (0.84 g O2 m-2 d) compared to respiration (1.91 g O2 m-2 d). We did not see large effects of salinity on GPP or ER, but salinity was relatively low during the study period. Laboratory assays showed that flocculation increased even with low levels of salinity. Our results suggest that even low levels of increased salinity could indirectly alter aquatic metabolism through flocculation by increasing light availability.

P-63: METABOLIC HETEROGENEITY AND OXYGEN DISTRIBUTIONS IN BIOFILMS

Molly Baker

T02: Biogeochemistry

Bacteria generally colonize surfaces in matrix-protected, organized communities referred to as biofilms. Biofilms are commonly found on solid surfaces in lakes and streams. Although biofilm growth is highly dependent on oxygen availability, very little is known about the oxygen dynamics within biofilms. We used planar optodes to observe the oxygen concentration profile within Pseudomonas aeruginosa biofilm colonies. Optodes provide a useful tool to examine oxygen patterns within biofilms under fluctuating environmental conditions (e.g. media flow, influent oxygen, biomass). Quantifying the metabolic activity of biofilms at the microscopic level is a useful step towards understanding the relationship between metabolism of riverbed biofilms, spatial patterns in habitat conditions, and net ecosystem metabolism and biogeochemistry.

P-64: ECOSYSTEM STOICHIOMETRY: BASAL C:N:P RATIOS AND NUTRIENT CYCLING IN TROPICAL STREAMS

Keeley MacNeill, Brady Kohler, Steven Thomas, Emma Rosi-Marshall, Alexander Flecker

T02: Biogeochemistry

Ecological stoichiometry is an important framework for evaluating trophic energy transfer in ecosystems and is a valuable way to assess quality of biomass available in food webs. Previous research shows that nutrient uptake in streams depends on available nutrient ratios. However, how the stoichiometry of uptake translates through trophic levels is not well known and is important because of direct impacts on food chain efficiency. Furthermore, while the stoichiometry of nutrient uptake by microorganisms affects the quality of nutrients available to food webs, most studies focus on carbon, nitrogen or phosphorus alone or in pairs. In order to examine how the stoichiometry of nutrients translates across trophic levels, we used TASCC to measure the N:P stoichiometry of nutrient uptake in the context of ambient DOC availability in Ecuadorian streams spanning a 2500m range, which contains a broad range of variation in terrestrial vegetation and groundwater inputs. We compared stoichiometry of ambient nutrients and nutrient uptake rates with the stoichiometry of microbial assemblages. Preliminary data support our hypothesis that stoichiometry of ambient nutrients correlates with both uptake rates and biofilm stoichiometries.

P-65: POTENTIAL MICROBIAL METHYLMERCURY PRODUCTION IN NORTH CAROLINA PIEDMONT STREAM SEDIMENTS

Peter Blum, Martin Tsui, Anne Hershey

T02: Biogeochemistry

Methylmercury (MeHg) is a potent toxin that is primarily produced by sediment dwelling anaerobic microbes. Documented mercury methylating microbes include sulfate reducing bacteria (SRB), iron reducing bacteria (FeRB), and methane producing archaea (MPA). SRB and MPA compete for acetate and hydrogen, and when sulfate is in excess SRB can outcompete MPA for these resources. SRB have been established as the dominant MeHg producers in many freshwater environments, but one study implicated MPA as the dominant methylators in lake periphyton. The potential contributions of these microbial groups in MeHg production in North Carolina Piedmont streams, where substantial methanogenesis is known to occur, is being evaluated in this research. Preliminary data from one stream suggested that when the activity of MPA was inhibited, mercury methylation remained unchanged. However, when the activity of SRB was inhibited there was low MeHg production, similar to when both microbial groups were inhibited. These preliminary data suggested that SRB were the dominant MeHg producers, and MPA and microbes other than SRB and MPA (including FeRB) had minor roles in sediment MeHg production in North Carolina Piedmont streams.

P-66: MODELING HYDROLOGIC PARAMETERS AND NITRATE UPTAKE IN EMMONS CREEK, A HIGH NITRATE COLD WATER STREAM IN EAST CENTRAL WISCONSIN

Eric Strauss, Carly Olson, Nathaniel Strauss, Robert Stelzer

T02: Biogeochemistry

High nutrient streams often exhibit saturation behavior including low nutrient uptake velocity and nearly-conservative nutrient transport. Consequently, nutrient spiraling studies in high nutrient streams are more difficult and less common because of this lower uptake. In October 2014, we performed tracer releases in a 400-m reach of Emmons Creek, a high NO3- (2.56 mg N/L) cold water stream in central Wisconsin to measure NO3- uptake and the hydrologic parameters affecting NO3- transport. We conducted a sustained injection of the dye Rhodamine WT and measured downstream concentrations to model hydrological parameters using the advection dispersion equation. A Mathematica notebook visualization tool was used for rapid initial parameter estimation and OTIS-P was used for final parameter optimization. A slug release of Rhodamine WT plus NO3- was used to measure NO3- uptake and data were analyzed with the breakthrough curve integration method. The calculated nutrient spiraling metrics (Sw = 4963 m; Vf = 0.018 mm/s) were similar to those measured on other systems of similar NO3- concentration and discharge. Application of the TASCC method was not successful on this dataset.

P-67: SEEING THE UNSEEN - COMBINING SOLUTE TRACERS WITH GEOPHYSICAL IMAGING TO MAP HYPORHEIC FLOWPATHS

Brady Kohler, Robert O. Hall, Matt Provart, Brad Carr

T02: Biogeochemistry

The hyporheic zone is important for many biogeochemical, hydrological, and ecological stream processes. However, it has remained difficult for researchers to sufficiently describe solute transport within the hyporheic due to our inability to "see" the subsurface directly. Our study, built on the experimental configuration of others, was designed to locate areas in a stream reach that exhibit relatively high rates of hyporheic exchange. We employed time-lapse electrical resistivity imaging combined with the addition of electrically conductive salt tracers to measure the subsurface dynamics of a stream in Wyoming's Snowy Range, yielding a longitudinal profile of the hyporheic zone. Solutes in our study reach travelled over 1 m deep into the hyporheic zone and flushed relatively quickly (~1 h). This new experimental configuration shows promise in its ability to illustrate where along a stream reach that hyporheic exchange is most prominent and where it is less significant, allowing for future studies to better describe these active regions using more elaborate electrode arrays and solute transport modeling.

P-68: USING PRECISION GRADIENT AND TURBULENCE MEASUREMENTS TO DETERMINE AQUATIC GAS FLUXES AND THE POTENTIAL SIGNIFICANCE OF NON-DISSOLVED GASES

Nicholas Gubbins, John Crawford, Emily Stanley

T02: Biogeochemistry

Streams are disproportionately important sources of greenhouse gas (GHG) exchange relative to their small surface area. The gas transfer velocity (k) determines the rate of diffusive gas exchange with the atmosphere. Our objectives were to use high precision methods for determining k and to quantify GHG fluxes from primarily agricultural streams. Gas transfer velocities for CO_2 and CH_4 in streams across Dane County, WI were measured and compared using an acoustic Doppler velocimeter and a suspended flux chamber technique. Additionally, dissolved and atmospheric gas gradients were measured directly using a GHG analyzer and gas equilibrator. Gradients for many streams were surprisingly large; some were > 10,000 ppm CO_2 and 1,000 ppm CH_4. Temperature-corrected k of both gases agreed closely for almost all streams. However, k values diverged for a fraction of sites, indicating potential vectors of non-Fickian exchange. As it is usually assumed that all gas exchange in streams is Fickian, it is important to consider that previously derived k and flux values could be artificially deflated. Additionally, these non-Fickian exchange pathways may contain other important GHG or biogenic gases.

P-69: A COMPARISON OF THE POTENTIAL RATES OF METHANOGENESIS AND METHANE OXIDATION IN SEDIMENT SLURRIES OF TWO URBAN AND TWO FORESTED STREAMS.

Allison Bullard, Anne Hershey

T02: Biogeochemistry

Methanogenesis is the dominant process for anaerobic decomposition, but has not been extensively studied in streams. Streams are often supersaturated in methane. Methane originates from both allochthonous and autochthonous sources. Here, we focused on autochthonous methanogenesis. CH4 oxidation by methanotrophs partially mitigates CH4 production. The urban stream syndrome describes how urban streams are ecologically degraded, undermining the ecosystem services provided compared to their forested counterparts. We hypothesized that the rate of methanogenesis would be higher in urban compared to forested stream sediments. Fieldwork was conducted on sediments from two urban and forested streams in NC. Sediment slurry experiments were conducted to evaluate methanogenesis and methane oxidation in surficial and deep sediments of all streams. Results showed the rate of methanogenesis was several orders of magnitude higher in urban stream sediments compared to forested stream sediments. The rates of methane oxidation were higher in surficial sediments of the urban streams compared to the forested streams of similar stream order. These results indicate the potential for greater importance of methane cycle processes in small, urban streams compared to their forested counterparts.

P-70: MEASURING NET DENITRIFICATION FLUX USING MEMBRANE INLET MASS SPECTROMETRY IN MOUNTAIN RIVERS

Molly Plemel, Robert O. Hall, Hilary Madinger

T02: Biogeochemistry

Denitrification removes nitrate in streams with high anthropogenic nitrate concentrations. In subalpine forest, forest type influences the density of logjams and thereby stream complexity, which we hypothesize increases aerobic respiration and denitrification. We measured net denitrification in six streams in the Front Range, Colorado and Wyoming, USA. Sites differed in forest type and thereby logjam density and stream complexity. Study sites also had high nitrate concentrations (0.15 mg NO3--N/L). We used dark bottle assays and oxic incubations to measure change in dissolved nitrogen and oxygen relative to argon gas concentrations to measure net denitrification flux and respiration from stream sediments. We found no relationship between organic matter content and the net denitrification flux. Net denitrification increased with respiration. With a whole stream respiration of -4 g O m-2 d-1, we estimated a whole stream net denitrification flux of 107 mg N2 m-2 d-1, which accounted for one third of whole-stream nitrate uptake.

P-71: INSIGHTS INTO SULFUR BIOGEOCHEMISTRY IN ALKALINE, CARBONATE-DEPOSITING HEADWATER STREAMS

Jessica R. Corman, Amisha Poret-Peterson, James Elser

T02: Biogeochemistry

Sulfur is a highly reactive element and its biogeochemical cycle is often linked to those of carbon, nitrogen, and/or phosphorus. While most studies of sulfur biogeochemistry pertain to the ecological effects of acid rain, we consider sulfur cycling in alkaline streams. For over three years (2011 – 2014), we monitored stream water chemical composition in headwater streams in the Huachuca Mountains of southern Arizona, USA. These montane streams are characterized by low nutrient concentrations and active calcium carbonate deposition. Across the streams, sulfate concentrations are positively correlated with calcium concentrations ($r2 = 0.45$, $p < 0.001$). Within a stream, downstream changes in sulfate and calcium concentrations are stoichiometrically constrained: 5 mol of $CaCO_3$ are produced per 1 mol of sulfate consumed. These observations suggest microbial sulfate reduction may be influencing calcium carbonate deposition. As calcium carbonate deposition can influence phosphorus availability, a link between microbial sulfate reduction and calcium carbonate deposition may be another way in which sulfur, carbon, and phosphorus cycles are coupled.

P-72: A CHAMBER-BASED APPROACH TO ASSESS CHANGES IN STREAM ECOSYSTEM METABOLISM AND NITRATE UTILIZATION AT REDUCED NITRATE LEVELS

Courtney Reijo, Matthew Cohen

T02: Biogeochemistry

Nutrient reduction strategies have become standard to protect stream ecosystems but we lack the tools to understand how systems respond to reduced concentrations. To fill this gap, we developed a chamber-based method which allows characterization of NO3 utilization along the two major uptake pathways at reduced levels. The chamber blocks flow by insertion into upper sediments, allows light in and sediment-water-air interactions to occur. At Gum Slough Springs, Florida, in-situ sensors measured water quality while NO3 reduced from ambient levels (1.40 mgN/L) to below regulatory thresholds (0.20 mgN/L) within one week. Daytime NO3 uptake, from plant uptake and denitrification, was consistently greater than nighttime uptake, or denitrification alone. Using this method, we compared UNO3 and GPP across multiple vegetation regimes and related GPP estimates from the chamber to reach scale. Our results suggest UNO3 and GPP differ by vegetation type, GPP can be scaled-up from the chamber to reach, algal presence potentially reduces GPP, and an overall lack of nutrient limitation. Overall, this method shows promise as a tool for in-situ ecosystem-scale assessments of nutrient retention below ambient concentrations.

P-73: VEGETATION EFFECTS ON NITRATE UPTAKE AND REMOVAL VIA DENITRIFICATION IN DITCH MESOCOSMS

Jason Taylor, Matt Moore, Thad Scott

T02: Biogeochemistry

We quantified differences in N retention and denitrification rates during experimental runoff events followed by stagnant periods in mesocosms planted in three different vegetation treatments: unvegetated; cutgrass; and common cattail. All treatments retained 60% or more of NO3-N loads during the 6 h experimental runoff event, but cutgrass had significantly higher (68%) retention compared to cattail (60%) or unvegetated (61%) treatments. After the runoff event, cattail mesocosms reduced NO3-N concentrations by > 95% within 24 h and cutgrass achieved similar reductions within 48 h, whereas reductions in unvegetated mesocosms were significantly less (65%). Cores from cutgrass mesocosms had significantly higher average denitrification rates (5.93 mg m-2 h-1) accounting for 56% of the immobilized NO3-N within 48 h, whereas denitrification rates were minimal in cores from unvegetated (-0.19 mg m-2 h-1) or cattail (0.2 mg m-2 h-1) mesocosms. While vegetated treatments removed excess NO3-N from the water column at similar and significantly higher rates than unvegetated treatments, the high denitrification potential of cutgrass highlights the potential for permanent removal of excess N from agricultural runoff in vegetated ditches and wetlands.

P-74: LINKING MUSSEL GROWTH DYNAMICS TO TEMPERATURE REGIMES: PREDICTING HOW FRESHWATER MUSSELS WILL RESPOND TO A CHANGING CLIMATE

Vincent Butitta, Emily Stanley, Andrew Rypel

T03: Climate Change

Of the nearly 300 species of freshwater mussels in North America, only ~25% are considered stable, making them the most endangered major faunal group. Many studies on mussel growth have examined relationships between growth and streamflow in lotic ecosystems. However, we investigated temperature-growth relationships for mussels in lake ecosystems (where hydrologic flows are absent to minimal). We analyzed shell thin-sections of Lampsilis siliquoidea from ten lakes in northern Wisconsin and quantified population- and individual-level rates of growth and growth synchrony. Von Bertalanffy growth parameters for one population (Trout Lake, Vilas County, WI) were the lowest recorded for a Lampsiline species (K=0.015), while maximum longevity was correspondingly high (37 years). We observed a high level of synchrony in annual growth among individuals (series intercorrelation: 0.346) and mussel growth was correlated to macroclimate indices (Pacific/North American, R=0.39) (Multivariate ENSO, R=0.34). Because synchrony in growth among individuals was tightly coupled with temperature, we also explored climate-growth relationships across lakes to understand how a warming climate will differentially affect diverse mussel populations.

P-75: LIVING IN EXTREMES: DISTRIBUTION AND THERMAL TOLERANCES OF PAROCHLUS STEINENII (CHIRONOMIDAE) IN THE SOUTH SHETLAND ISLANDS, ANTARCTICA AND SUBANTARCTIC REGION OF CHILE (55oS)

Tamara Contador , James Kennedy

T03: Climate Change

Antarctica and sub-Antarctic regions have become a focus of studies on environmental responses to regional and global change. Little is known about the life history and thermal tolerances of the widely dispersed P. steinennii in the region. The goals of this study were to contribute to the knowledge of its distribution and thermal tolerance. During Jan. and Feb. of 2014 and 2015 in a study coordinated by the Chilean Antarctic Institute we navigated to the region aboard the Chilean AP Aquiles. We surveyed and characterized habitats in permanent and non-permanent freshwater. Larval pupae, and adults were collected live to determine thermal limits in the laboratory. Our survey provides the first distribution records of P. steinenii for Deception Island. Study results reveal that P. steinenii larvae, pupae, and adults have an exceptionally wide thermal range, ranging from -9 to 35oC. Further studies are underway to understand the current distribution and thermal limits of P. steinenii in region. The ultimate goal is to establish P. steinenii as an indicator of climate change for Antarctica and Sub-Antarctic region.

P-76: INVESTIGATING THE IMPACTS OF RETROGRESSIVE THAW SLUMPS ON ECOSYSTEM STRUCTURE AND FUNCTION IN ARCTIC STREAMS, NWT

Brianna Levenstein, Joseph Culp, Jennifer Lento, Krista Chin, Steve Kokelj

T03: Climate Change

Retrogressive thaw slumps (RTS), landscape features formed from permafrost degradation, are increasing in size and frequency in the western Canadian Arctic. The debris from RTS flows into nearby stream systems, greatly changing the physicochemical properties of the stream, however, little is known about the biological impacts of this abiotic disturbance regime. This study investigated how benthic macroinvertebrate (BMI) communities, decomposition and benthic algal standing stock were impacted by RTS. Sampling sites were located upstream and downstream of RTS. BMIs were collected using standardized Canadian protocols (CABIN), decomposition was measured using cotton strips and benthic algal standing stock was assessed using both nutrient diffusing substrates (NDS) and artificial substrates without nutrient addition. The NDS showed that nutrients were not limiting. Moreover, RTS disturbance was associated with a significant decrease in algal biomass accumulation. Decomposition of the cotton strips showed no relationship with disturbance. Finally, BMI abundance appeared to decrease along a disturbance gradient, while diversity remained similar to reference conditions. This study shows that RTS cause a shift in the biological structure and function of Arctic stream ecosystems.

P-77: DAMSELS IN DISTRESS! PROXIMAL EFFECTS OF CLIMATE CHANGE ON THE DEVELOPMENT AND SURVIVORSHIP OF A MODEL ORGANISM (INSECTA, ODONATA: ENALLAGMA CIVILE).

Scott Starr, Nancy McIntyre

T03: Climate Change

Current climate change predictions estimate increased air temperatures across the southern Great Plains, putting many organisms at risk from environmental changes affecting larval and adult life stages. Proximally, increased air temperatures can lead to elevated water temperatures, but experiments are lacking on potential responses in terms of ontogenetic development or survival. The familiar bluet damselfly (Odonata, Coenagrionidae, Enallagma civile) was chosen to examine these effects because this widespread and abundant species can serve as a model for responses by other aquatic and amphibious animals. Eggs were collected and reared under four water temperature regimes (26, 32, 38, and 41°C). Once eggs hatched, nymphs were placed into individual containers and were observed and fed each day. Body measurements after molts, development rate, and deaths were recorded daily. Nymphs in the two hotter treatments had reduced survivorship; individuals in colder temperatures survived to adulthood. Individuals in 32°C emerged the quickest, going from egg to adult in 38 days. Elevated temperatures can thus be advantageous and detrimental, causing concern for aquatic invertebrates in the future.

P-78: THE EFFECT OF HYDROLOGICAL AND CLIMATE VARIATION ON MACROINVERTEBRATE ABUNDANCE AND RICHNESS IN SOUTHEASTERN OHIO

Mariah Thrush, Kelly Johnson, Jen Bowman

T03: Climate Change

Southeastern Ohio is thought to be a temperate area, with four seasons. When examining stream discharge, a pattern of wet winters/springs and dry summers/falls emerged. The effect of drier or wetter conditions on macroinvertebrate communities in southeastern Ohio streams is not known. We analyzed macroinvertebrate data collected from three watersheds for seven years for patterns in abundance, taxonomic richness, and a biotic index, the Macroinvertebrate Aggregated Index for Streams (MAIS). Using Palmer's Drought Index, wet, dry, and mid-range years were identified from seven years. For each of the year types, the relationship between macroinvertebrate metrics of that year and the variation across the timespan were correlated; this is to evaluate how each type of year compares to the overall variation. Abundance had no significant correlations to wet, mid-range, or dry years (p= .15, .16, .55, respectively). Significant correlations to all three year types were found for taxonomic richness (p = 1.87E-7, 1.39E-6, 1.63E-4) and MAIS (p = 5.46E-10, 6.28E-6, 8.98E-8), with general negative trends when graphed. The correlation between maximum flow and abundance were investigated; no significant effects were found.

P-79: GLOBAL REVIEW OF CLIMATE-GROWTH RELATIONSHIPS FOR FRESHWATER MUSSELS

Andrew Rypel, Vincent Butitta, Emily Stanley, Andrea Fritts, Wendell Haag

T03: Climate Change

Freshwater mussels are among the most endangered organisms on Earth and play pivotal roles in the structure and function of ecosystems. Recently a new science called “sclerochronology” has emerged, which is a direct analogue to tree-ring science but applied to growth rings in mussel shells. Tree-rings have been crucial to addressing fundamental long-term ecological questions in terrestrial ecosystems, and sclerochronology holds similar promise for better understanding freshwater environments. We reviewed available freshwater mussel sclerochronology studies across multiple continents and ecosystem types (n>50) and present some initial meta-analysis results. Synchrony in freshwater mussel growth (assayed as mean population-level interseries correlation) is apparently common in mussel populations (mean interseries R range: 0.27-0.99, median = 0.64. In lotic ecosystems, freshwater mussel growth is often significantly and negatively related to streamflow (low flow = above average growth). However in lentic ecosystems, annual mussel growth tends to correlate positively with temperature variability. Sclerochronology science is likely to grow rapidly in the coming years and will be useful for understanding freshwater ecosystem dynamics including conservation management implications for freshwater mussels.

P-80: CARBON STOCKS IN PAPUA NEW GUINEA MANGROVES

Charlie Yak, Freddie Alei, Peter Katapa, Joko Purbospito, Richard MacKenzie

T03: Climate Change

Mangrove ecosystems provide numerous ecological services that include protection from storms, regulation of water quality, nursery and feeding habitats for fish and shellfish, important sources of fuel and fiber for local human populations, and support of biodiversity through provision of habitat for many rare and endangered species. The high rates of primary productivity coupled with anaerobic soil conditions in mangrove forests provide another service in that they may offset climate change impacts through sequestration and long-term storage of carbon (C). Although preliminary studies have demonstrated that C stocks in these ecosystems are among the highest of any forest type, their potential as C sinks continues to be ignored in many Southeast Asian countries. This includes Papau New Guinea, where some of the largest intact and diverse mangrove forests exist and that support high densities of trees that are often > 100 cm DBH. Initial carbon data will be presented from coastal mangroves of Manus Island as well as compared to other carbon stocks from other mangroves in this region.

P-81: ANALYSIS OF LONG-TERM DISCHARGE TRENDS IN LOTIC SYSTEMS OF KENTUCKY, USA

Jean Branttie, Tamara Sluss

T03: Climate Change

Streams and rivers are vital for drinking water, recreation, aquatic life, agriculture, municipal, and industrial uses in Kentucky, USA and extreme levels jeopardize human health and the local economies. Discharge data for lotic systems across a range of watershed sizes (1000 to 2X10^5 km2) in Kentucky, USA, were obtained from the USGS and analyzed for long-term (>70 years) trends. Annual mean, maximum, minimum, standard deviation were analyzed with time (water years 1940-2013). Data were highly variable and relationships were weak (R-squared=0.01-0.3). However, the annual mean and minimum in 4/5 systems (all but the smallest and unregulated stream) increased while the annual maximum and standard deviation for the same systems decreased and may indicate prolonged high discharge events or management to increase minimum levels. Recent water projects such as municipal pipelines and flood management might have contributed to the variability within the study years along with potential climate change influences. Including more systems, assessing duration of flow events, and continuous monitoring are imperative for informed water management and planning decisions in light of discharge variability.

P-82: SPATIAL VARIATION AND CONNECTIVITY OF SPRING COMMUNITIES IN JOHN BRYAN STATE PARK.

Jamie Bonino, Schelby Rosebrook, Mira Lukkarila, Leslie Riley, Robert Verb

T04: Aquatic Ecosystem

Freshwater springs are often associated with high species diversity. Compared to rivers, springs often have unique physicochemical characteristics and a reduced number of disturbance events. Often, though, springs flow directly into larger, more highly disturbed lotic systems. Despite the prevalence of these confluences, few studies have examined spatial variation in community structure across both habitats. The objective of this study was to examine community structure and the distribution of selected taxa across two springs and the Little Miami River within a limestone gorge at John Bryan State Park (Yellow Springs, Ohio, USA). In each spring, we measured selected physical/chemical parameters and collected periphyton, macroalgae and macroinvertebrates. Similar collections and measurements were conducted in three riffle sites in the Little Miami River, corresponding to upstream, downstream and in between the river and spring points of confluence. Amphipods and isopods were dominant in both springs, but absent from the river. Many diatom genera were found in both habitats (e.g. Navicula), though some displayed more restricted distributions (e.g. Meridion). These results suggest that springs may act as refugia for some macroinvertebrate taxa.

P-83: ENVIRONMENTAL DNA (eDNA) SUCCESSFULLY DETECTS INVASIVE RUSTY CRAYFISH (O. rusticus) AT LOW ABUNDANCES

Matthew Dougherty, Eric Larson, Mark Renshaw, Crysta Gantz, David Lodge

T04: Aquatic Ecosystem

Early detection is vital for the management of species invasions, and environmental DNA (eDNA) is emerging as an important monitoring tool to this end. We tested the ability of eDNA to detect invasive rusty crayfish (O. rusticus) presence and represent abundance of this species in 12 lakes of Vilas County, Wisconsin, representing a known gradient of O. rusticus absence to high abundance during the summer of 2014. We estimated O. rusticus abundance by baited trapping at lakes, and paired these trap locations to 10 surface water samples per lake that were filtered for eDNA and sequenced as quantitative PCR (qPCR) on primers developed for O. rusticus. We successfully detected O. rusticus presence by eDNA down to catch-per-unit effort (CPUE) of 0.17 crayfish per trap, and the proportion of water samples yielding positive detections of O. rusticus increased with increasing CPUE. Our study demonstrates that eDNA may have high utility in monitoring for early detection of invasions by crayfish like O. rusticus, and we anticipate that further methodological advancements may yet improve on these results.

P-84: PATTERNS AND DRIVERS OF SPECIFIC CONDUCTANCE IN NEW HAMPSHIRE RIVERS

Jody Potter, William H. McDowell, Lisle Snyder

T04: Aquatic Ecosystem

We deployed a network of high frequency sensors measuring specific conductance (SC) and discharge (along with a variety of other parameters) throughout New Hampshire in streams (n = 10) with a variety of land cover. Streams with anthropogenic influence have higher conductance, likely a result of road salt application as indicated by a correlation with basin % impervious surface. Estimated Cl- concentrations indicate urbanized streams often exceed the US EPA chronic toxicity standard for aquatic life (230 mg Cl-/L). SC generally dilutes with stormflow, although in our most urbanized stream SC increases with discharge in the winter and dilutes the rest of the year. Timing of the minimum SC during storms is different among streams, indicating different sources and flow paths, which has the potential to provide insight into the biogeochemistry of other ions such as nitrate. From a management perspective, decreased salinization of our surface waters is critical and practices that reduce the use of road salt and minimize impervious surface area could lead to improvement of water quality.

P-85: WADEABLE STREAM PHYSICAL AND CHEMICAL CHARACTERISTICS IN TWO ECOREGIONS OF THE NORTHERN PLAINS

Lyntausha Kuehl, Chad Kaiser, Katie Bertrand, Nels Troelstrup

T04: Aquatic Ecosystem

With rising concerns over water consumption and quality, regional baseline data of aquatic resources are important to inform management decisions. However, northern prairie streams remain largely under-described. Streams were sampled using modified EPA REMAP protocols in the Northern Glaciated Plains (NGP, 2010 and 2011) and Northwestern Great Plains (NWGP, 2014 and 2015) in South Dakota. Our objective was to evaluate LIII and LIV ecoregion differences in physical and chemical characteristics. Ecoregion comparisons were made with Kruskal-Wallis ANOVA. The NGP had higher total phosphorus concentrations (mean = 0.56 mg/L) and a lower proportion of clay substrate (mean 0.9%) than the NWGP (mean = 0.19 mg/L and mean = 13.2%, respectively). Level IV ecoregion differences were more numerous from the NWGP than the NGP, suggesting greater intraecoregion variability. The Big Sioux Basin and James River Lowland appeared highly distinct in the NGP as did the River Breaks, Sagebrush Steppe, and Moreau Prairie in the NWGP. Pronounced intraecoregion variation must be a consideration to maximize effective monitoring and management of northern prairie streams.

P-86: BRINGING THE LABORATORY OUTDOORS: WHAT CAN WE LEARN WITH AN EXPERIMENTAL STREAM?

Jessica Kozarek

T04: Aquatic Ecosystem

Experimental studies provide insight into river and stream processes by controlling for key environmental variables such as flow. To investigate the interactions between flow, vegetation, and biota, however, requires that experiments be conducted at full scale conditions. The Outdoor StreamLab (OSL) at the St. Anthony Falls Laboratory (SAFL) enables high-resolution local measurements in an outdoor sand bed stream (3 m wide) constructed in 2008 with a vegetated floodplain (40 m by 20 m). Because both water and sediment feed can be controlled, the OSL facilitates experiments on the physical, chemical, and biological interactions between a channel and its floodplain. This system, fed by Mississippi River water, is capable of a wide range of flows from baseflow (44 L/s) to large overbank floods (1200 L/s). A synthesis of major OSL research findings since 2008 will be presented including: surface water-groundwater interactions, stream and floodplain biogeochemistry, invasive species management and stream restoration. This presentation will address the following questions: what can we learn from field-scale stream experiments, what are the limitations of these experiments, and what opportunities exist for future research?

P-87: THE AQUATIC EFFECTS OF HEMLOCK DECLINE IN HEADWATER STREAMS IN SOUTH-CENTRAL PENNSYLVANIA

Alicia Helfrick, Theo Light

T04: Aquatic Ecosystem

In recent decades, eastern hemlock (Tsuga canadensis) has declined in the eastern United States due to invasive hemlock woolly adelgid (Adelges tsugae). Based on comparative studies, aquatic systems are expected to change with the replacement of hemlock by deciduous tree species, but few have tested this hypothesis directly. We sampled macroinvertebrates, fish, and riparian vegetation in 15 hemlock-dominated sites of varying conditions in south-central Pennsylvania. Neither hemlock cover nor condition directly influenced fish or water quality variables. However, excluding streams with heavy rhododendron (Rhododendron maximum) cover, black birch (Betula lenta) canopy cover was positively associated with the decline of understory hemlock. In turn, stream temperature declined, whereas nitrate levels increased, with increased birch canopy cover. Fish biomass and density were influenced by pH and water temperature, but not hemlock cover or condition. Macroinvertebrate data is still being processed, but we expect to see taxonomic and functional feeding group differences due to forest succession. In these sites, adelgid-infested riparian hemlock was rapidly replaced by birch, which in turn altered the aquatic environment with possible influences on fish and macroinvertebrates.

P-88: AN EVALUATION OF THERMAL CRITERIA IN WYOMING SURFACE WATER QUALITY STANDARDS

Caitlin Peterson

T04: Aquatic Ecosystem

Temperature is a significant determinant of fish distribution due to its impact on fish metabolism, reproduction, and behavior. Because surface water thermal regimes are highly vulnerable to anthropogenic influence, states must establish management standards in order to maintain thermal conditions suitable for aquatic life. The objective of this study is to evaluate the Wyoming surface water temperature standards and propose revisions where needed. We will present our approach for developing temperature standards to adequately protect Wyoming aquatic life, focusing on our division of fish species into multiple management guilds based upon their thermal requirements. We will also discuss our development of the instantaneous and weekly allowable thermal maxima used to define each guild. An improved understanding of Wyoming fish species' thermal requirements will allow for better management of Wyoming surface waters.

P-89: LINKING HYDROLOGIC REGIME, RAINFALL AND LEAF LITTER FALL IN A RIVERINE FOREST WITHIN THE RAMSAR SITE HUMEDALES CHACO (ARGENTINA)

Sylvina Lorena Casco, María Eugenia Galassi, Eliana Karina Alejandra Mari, Alicia Susana Guadalupe Poi, Juan José Neiff

T09: Conservation and Restoration

We analyze the pattern of leaf litterfall and the breakdown rate in a mixed gallery forest that covers the levees of the Paraná River oxbow lake. Litter fall was collected biweekly for four year that represents different rainfall and hydrologic regime of the Paraná River including flood and prolonged drought. Litter bags were incubated on the forest floor during flooding conditions and dry conditions and in the oxbow lake. Our results suggest that with the increasing severity of the dry season and decreasing hydrologic connectivity, the annual leaf litterfall increases, whereas its seasonal pattern does not change. Regardless of the seasonal pattern of rainfall and hydrological regime in each study period, leaf fall occurred throughout the year. Leaves decomposed fastest in oxbow lake, and the leaf breakdown on the forest floor was slower during flooding conditions than in dry conditions. Regular floods are natural occurrences that not affect the leaf production of the mixed forest and the leaf processing depends on the oxygen concentrations. Prolonged droughts led to high annual leaf production, which is mainly processed within this forest.

P-90: THE CALIFORNIA DROUGHT: BIOLOGICAL RESPONSES OF LARGE RIVER SALMONIDS AND EMERGENT MANAGEMENT CHALLENGES

craig anderson

T05: Large River Ecology

As California endures the 4th consecutive year of below normal precipitation and runoff, the state's reservoirs are at an all time low storage condition. As a consequence, instream flows that support a variety of threatened and endangered salmonid species have also been at record low levels. The biological responses of the federally listed winter-run Chinook salmon, spring-run Chinook salmon (Oncorhynchus tshawytscha), and Central Valley steelhead (Oncorhynchus mykiss)populations, as well as Sacramento-San Joaquin Delta pelagic species such as Delta smelt(Hypomesus transpacificus), have resulted in extremely low abundance estimates and poor overall fish health. This poster summarizes California's hydrologic conditions over the past decade and links resultant impacts of the drought conditions to both adult escapement and juvenile production estimates in California's major inland salmon rivers over that same time span. We will also examine local, state, and federal regulatory actions both in response to the extreme hydrologic regime and in preparation for continued, ongoing drought conditions.

P-91: COMPARING ENERGY DENSITY OF THREE COMMON FOOD ITEMS IN A GREAT LAKES COASTAL RIVER SYSTEM

Emily Dean, Mark Luttenton

T05: Large River Ecology

Sources of energy available to resident stream fish populations have been widely studied. Although stream insects are often considered the basis of stream fish energetics, other energy sources may be available seasonally, particularly during adfluvial fish spawning runs. We compared the energy density of adult caddis (spring), Chinook salmon eggs and muscle (fall), and larval white suckers (spring) in the Manistee River system, MI using Parr micro-bomb calorimetry. Energy densities of Chinook muscle, Chinook eggs, caddis adults, and larval white suckers were 4,853.4 cal/g, 6,158.8 cal/g, 6,743.2 cal/g, and 6,150.1 cal/g respectively. Given the large number of individuals that return to coastal rivers during seasonal spawning runs and the high caloric density which is comparable to adult caddis, adfluvial fish may supplement energy available to fish populations in coastal stream systems.

P-92: EFFECT OF SUBMERGED VEGETATION ON THE CONTRIBUTION OF SHOAL AND BACKWATER HABITATS TO LARGE RIVER BENTHIC INVERTEBRATE DIVERSITY

Jordan Barton, Matthew McTammany, Matthew Wilson, Claire Rapp, Ashley Bruno, Meghan Reilly

T05: Large River Ecology

Variability in macroinvertebrate communities can be observed by exploring differing microhabitats in the West Branch Susquehanna River. In contrast to studying typical riffle habitats, invertebrates were collected from shoals (shallow, fast flowing, high oxygen, gravel habitats) and backwaters (deep, slow flowing, low oxygen, sand and silt habitats), both with and without vegetation (primarily water willow, Justicia americana). Invertebrates were identified to determine how community structure varies by habitat type and submerged vegetation. Backwater sites contained more vegetation, but stem densities and depth-adjusted biomass did not differ between vegetated backwaters and shoals. Shoals demonstrated higher invertebrate diversity than backwaters, but diversity was reduced in shoals with vegetation. Invertebrate diversity was similar in vegetated and non-vegetated backwaters, but density was 2x higher in backwaters with vegetation. Similar to riffle habitats, EPT's dominated shoal habitats and were not affected by vegetation. Non-insect invertebrates and chironomids were abundant in backwater sites, and increased in number with presence of vegetation. Backwaters, although common in the Susquehanna River, are not typically sampled for invertebrates, despite contributing unique taxa and adding to our understanding of river biodiversity.

P-93: REDUCTIONS IN JUVENILE MUSSEL GROWTH ALONG A RIVERINE GRADIENT OF CYANOBACTERIAL ABUNDANCE: THE IMPORTANCE OF PARTICLE SIZE AND FATTY ACID CONTENT

Lynn Bartsch, Michelle Bartsch, William Richardson, Jon Vallazza, Brenda Moraska Lafrancois

T05: Large River Ecology

Recent increases in nutrient and sediment loading have caused observable changes in the algal community composition and may have altered the quality of mussel food in the St. Croix National Scenic Riverway. Juvenile Lampsilis cardium and L. siliquoidea were deployed in cages for 28 d at four riverine and four lacustrine sites. Mussel foot tissue and food resources (four seston fractions and surficial sediment) were analyzed for quantitative fatty acid (FA) composition. Riverine sites were dominated by Chlorophyta, whereas Cyanophyta generally dominated lacustrine sites. Mussel survival was high (95%) for both species; however, growth varied. Lampsilis cardium did not exhibit growth (?9 and ?7 ?m/d for riverine or lacustrine sites, respectively). Overall, L. siliquoidea grew (25 ?m?d at riverine and 11 ?m?d at lacustrine sites), but not at sites where Cyanophyta exceeded a threshold of 10% of the total phytoplankton biovolume. Lampsilis siliquoidea growth was positively correlated with volatile solids (< 32 ?m fraction) and with select FA not associated with cyanophytes. Sites dominated by Cyanophyta may not provide sufficient food quality to promote or sustain mussel growth.

P-94: RE-INTRODUCTION EFFORTS AND CURRENT DISTRIBUTION OF AMERICAN EEL IN THE SUSQUEHANNA RIVER BASIN

Aaron Henning

T05: Large River Ecology

Under the guidance of The Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC), The United States Fish and Wildlife Service (USFWS) and hydroelectric project operators have begun an effort to re-introduce the native American eel (Anguilla rostrata) to the Susquehanna River Basin. Volitional upstream passage of American eel to the watershed has been restricted by the presence of hydroelectric dams on the lower Susquehanna River since the early 20th century. A trap and transport project initiated by USFWS has resulted in over 500,000 eels being stocked upstream of the hydroelectric projects since 2008. Stocking success has demonstrated by rapid growth and dispersal of transported eels.

P-95: A COMPARISON OF THE BACTERIOPLANKTON ASSEMBLAGES FROM THE LARGE-RIVER FLOODPLAIN LAKES OF THE AMAZON, ARAGUAIA, PARANA AND PARGUAI (PANTANAL) RIVERS, BRAZIL

Michael Lemke, Rob DeSalle, Mercer Brugler, Michael Tessler, Rebecca Hersch, Luiz Felipe Velho

T05: Large River Ecology

With its network of lotic and lentic habitats that shift during changes in seasonal connection, the tropical-subtropical large-river systems represent possibly the most dynamic of aquatic environments. An unresolved question is if the habitat diversity and seasonal disturbance create high microbial diversity that changes with river flooding. Pelagic water samples were collected from floodplain lakes (n=16-20) in each of four flood-pulsed river systems in Brazil during the dry (non-flood) and wet periods in 2011-12. Field and laboratory measurements were taken. Samples were filtered, DNA extracted and 16S rDNA 454 next-generation sequences generated. We report a comparison of the bacterioplankton makeup of Brazil lakes and river systems with similar systems across the globe. The results indicate a surprising similarity at higher taxonomic levels, but a huge novel diversity at the generic and species level. We also compare the bacterial assemblages from the four river basins and describe the importance of river connection during the dry to wet seasons. These data better describe the bacteria community as influenced by highly dynamic river systems.

P-96: WHAT CAN WE LEARN FROM A FROZEN RIVER? WINTER OXYGEN, NUTRIENT, AND CHLOROPHYLL CONCENTRATIONS IN THE UPPER MISSISSIPPI RIVER.

Jeffrey Houser

T05: Large River Ecology

Winter is often neglected in the study of large rivers and the contribution of this season to nutrient cycling and primary production is poorly known. Long-term (1994 – 2013) winter data collected from floodplain backwaters within three study reaches distributed across 440 km of the Upper Mississippi River were used to examined how river discharge, snow and ice thickness affected dissolved oxygen, water temperature and flow velocity and the consequences for variation in chlorophyll, nutrient and suspended sediment concentrations. Oxygen and temperature were both significantly correlated with snow and ice thickness, but not discharge. There was a clear threshold in the response of chlorophyll, total phosphorus, and ammonia to flow velocity—maximum values were consistently observed at sites with flow velocities < 0.01 m s-1. Maximum nutrient and chlorophyll concentrations (> 100 µg L-1 chlorophyll; > 0.5 mg L-1 total phosphorus; > 4 mg L-1 total nitrogen) suggest that in some backwater areas there was substantial under-ice primary production.

P-97: COMPARISON OF 13C AND 15N DISCRIMINATION FACTORS AND TURNOVER RATES BETWEEN CONGENERIC CRAYFISH ORCONECTES RUSTICUS AND O. VIRILIS

Mael Glon, Eric Larson, Kevin Pangle

T06: Invasive Species

Accurate results of stable isotope analyses in ecology are dependent on knowing organism-specific consumer-diet discrimination factors (?). We used an 80-day laboratory experiment to test for differences in the ?13C and ?15N and metabolic turnover rates (m) of two species of crayfish (Orconectes rusticus and O. virilis) fed one of two diets (algae wafers or bloodworms). Over the course of the experiment, the ?13C and ?15N signatures of the crayfish reached equilibrium with those of their diets. By fitting these data to a growth-based model, we found ?13C, ?15N and m to be largely indistinguishable between species, except in the case of ?15N and m of crayfish on the algae wafer diet. We thus pooled parameters to calculate ?13C (algae wafer diet: 1.57 [Confidence Interval: 0.86, 2.35]; bloodworm diet: 0.8 [0.14, 1.55]) and ?15N (bloodworm diet: 1.2 [0.32, 2.11]), and used species-specific data to calculate ?15N for the algae wafer diet (O. rusticus: 2.54 [2.06, 3.08]; O. virilis, 3.35 [2.53, 4.51]). Differences in discrimination factors between crayfish species could have important implications for field-based stable isotope studies.

P-98: INVASIVE MYRIOPHYLLUM SPICATUM AND NUTRIENTS INTERACT TO INFLUENCE PHYTOPLANKTON COMMUNITIES IN THE PORTAGE WATERWAY

Jade Ortiz, Amy Marcarelli, Kevyn Juneau, Casey Huckins

T06: Invasive Species

Eurasian watermilfoil, Myriophyllum spicatum, is a nonindigenous macrophyte that may directly compete with phytoplankton that comprise the base of aquatic food webs. We conducted a mesocosm experiment testing the effects of nutrient loading (20 µg/L P and 145 µg/L N in a 16:1 molar ratio) and presence of M. spicatum on phytoplankton communities in a full two-way factorial design (12 mesocosms, n=3 for each treatment). After 30 days, total phytoplankton biovolume was 3X greater in the nutrient-enriched mesocosms regardless of the presence of M. spicatum. Cyanobacteria such as Anabaena sp. were more common in the nutrient-enriched treatments, while attached green algae such as Cladophora and Bulbochaete spp. were more abundant in the treatments with M. spicatum. Water column chlorophyll a concentrations were highest in the nutrient treatment without plants and the lowest in the nutrient + M. spicatum treatment suggesting that the attached algae negatively interacted with phytoplankton. In conclusion, the presence of macrophytes such as M. spicatum may enable enhanced growth of attached algae, increasing competition for nutrients and causing taxonomic shifts in the phytoplankton communities.

P-99: COEXISTENCE OR COMPETITIVE DISPLACEMENT? ENDEMIC AND INVASIVE FRESHWATER SNAILS IN THE GREATER YELLOWSTONE ECOSYSTEM

Nicole Berry, Jonathan Stechschulte, Leslie Riley

T06: Invasive Species

The invasive New Zealand mud snail (Potamopyrgus antipodarum) first appeared in the Greater Yellowstone Ecosystem (GYE) in 1994 and has since spread rapidly, becoming the dominant macroinvertebrate in many streams. In two streams, Potamopyrgus overlaps the entire Wyoming range of the endemic Jackson Lake spring snail (Pyrgulopsis robusta). Our previous studies indicated that Potamopyrgus and Pyrgulopsis compete for periphyton resources and suggested that the two species were coexisting in one stream (Marmot Spring), but that Pyrgulopsis was being displaced in a second stream (Polecat Creek). The objective of this project was to test whether Pyrgulopsis was being displaced in either of these two locations by comparing current snail densities (2014) to past densities (2001 – 2007). We collected four Surber samples in riffles and three stovepipe samples in depositional areas at four sites in Marmot Spring and two sites in Polecat Creek in July 2014 that corresponded to previous snail collection sites. Preliminary analyses suggest that Potamopyrgus densities have declined in riffle habitat in both streams, while Pyrgulopsis densities are not significantly different from a decade ago.

P-100: HABITAT AND ENVIRONMENTAL VARIABILITY DUE TO WATERCRESS GROWTH IN SPRINGS

Kambridge Brown, Elizabeth Bergey

T06: Invasive Species

Watercress (Nasturtium officinale) is a perennial herb introduced into North America in the eighteenth century and now occurs across the United States and southern Canada. Watercress thrives in springs, where it can form dense beds. Our study examined the ecology and ecosystem effects of watercress in springs and seeps, using sites in Oklahoma. We found that light levels influenced the presence and density of watercress beds. Beds provide architecture that slows water flow within and downstream of beds, where organic matter and fine sediments accumulate. Macroinvertebrates face a trade-off between having an increase in habitat diversity because of bed structure versus possible exposure to allelopathic chemicals produced by the plants.

P-101: THE EFFECTS OF SALINITY ON GROWTH RATE AND HYDRANTH MORPHOLOGY IN THE INVASIVE COLONIAL HYDROID CORDYLOPHORA

Nadine Folino-Rorem, Corbin Renken, Helen Harvey

T06: Invasive Species

Cordylophora is an invasive colonial hydroid indigenous to the Ponto-Caspian region. The ability to survive in a wide range of salinities contributes to its global occurrence in fresh and brackish waters. To understand this hydroid's response to various salinities, we acclimated colonies of two separate genotypes (one freshwater and one brackish) to a range of salinities from 0 to 22 ppt. Over three weeks we quantified growth rates of each colony and assessed changes in morphological characteristics. We compared growth rates and morphological differences between both genotypes at each salinity treatment. Our results indicate that optimal growth rates for both genotypes occur at salinity levels near those of their native site while growth rates decreased as the salinity increased (or decreased) from their native salinity. In addition, replicate colonies of both genotypes demonstrated that morphological plasticity of hydranth length and width, tentacle length and number is influenced by environmental salinity. These results in conjunction with molecular data will assist taxonomists in clarifying the lineages and aspects of physiological acclimation abilities in the euryhaline hydroid Cordylophora.

P-102: MICROCYSTIS AERUGINOSA REDUCES SPERM MOVEMENT IN INVASIVE DREISSENID MUSSELS

Karim Alame, Donna Kashian, Anna Boegehold, Nicholas Johnson

T06: Invasive Species

Dreissenid mussels pose a threat to many North American watersheds, displacing natural fauna and contributing to harmful algal blooms. Dreissenid mussels are known for their high reproductive rate, which contributes to their invasiveness. Examining algal factors that affect dreissenid reproduction may aid in the development of dreissenid control programs. The aim of this study is to evaluate the effects of phytoplankton on dreissenid gamete response. Mussels were exposed to a known spawning inducer in the presence of Ankistrodesmus falcatus (a palatable green algae), and Microcystis aeruginosa (a toxic cyanobacteria). Sperm in Ankistrodesmus treatments appeared fluid and dynamic, however, sperm exposed to Microcystis were noticeably clumped and immotile ($p<0.001$). We also quantified movement and velocity of sperm when exposed to Microcystis and Ankistrodesmus. Our findings indicate phytoplankton can impact dreissenid reproduction; specifically that Microcystis can adversely affect gamete function. If the chemical isolate from Microcystis that disrupts sperm behavior is different from the agent that is toxic to other organisms, a chemical tool for reducing dreissenid reproduction might be derived from cyanobacteria as a control method.

P-103: FAUCET SNAIL DECONTAMINATION METHOD FOR THE AVERAGE WATER ENTHUSIAST

Debbie Guelda, Jared House, Sabin Adams, Charlotte Roy

T06: Invasive Species

The invasive faucet snail, Bithynia tentaculata, acts as an intermediate host for many digenetic trematodes that infect and cause mortality of waterfowl. The faucet snail can resist desiccation for up to 7 days in dry containers and in mud much longer, increasing the risk of transport of viable organisms. To prevent introduction to new water bodies, proper decontamination is essential. Currently accepted decontamination methods are exposing snails to 50 C water (1 minute), or Hydrothol 191 (24 hours), but these methods are not accessible to most citizens. The objective of this study was to determine time needed to achieve 100% mortality of faucet snails by freezing (at -18.6 ± 1.3 C). Snails were subjected to five time trials (5, 10, 30, 60, and 120 min) within the freezer and controls were left at room temperature. Results indicate that snails experienced 100% mortality in 30, 60 and 120 minute treatments dry, and 100% only in 120 minute treatments for wet conditions.

P-104: SEX DESPITE THE COST: ATTACHMENT OF LIMNOPERNA FORTUNEI (DUNKER, 1857) ALTERS APPLE SNAIL ACTIVITIES EXCEPT MATING IN NATIVE POMACEA (LAMARK, 1822)

Averi Segrest, Cristhian Clavijo, Kenneth Hayes, Romi Burks

T06: Invasive Species

Studies of non-native freshwater mollusks provide insights into invasion success and impacts on native species. The Golden Asian Mussel, Limnoperna fortunei, occurs as a non-native invasive species in South America, which is home to a high diversity of apple snail species. Although native in Uruguay, certain apple snail species within the genus Pomacea are also invasive pests worldwide. Field observations indicate that L. fortunei settle on apple snail shells. To examine potential impacts of L. fortunei settlement on apple snails, we attached bivalve shells, filled with sand to stimulate average weight, to the shells of living Pomacea sp. (N=5). We observed activities of snails (feeding, mating, respiration, resting) during a 48-hour period with a 30 minute block every four hours. The presence of L. fortunei on shells did not decrease or prevent mating activities. However, Pomacea species with bivalves attached exhibited a reduction in non-mating activities, suggesting an increased cost in terms of energy expenditure from the additional weight and drag. Future work will examine interactions between non-native populations of Pomacea and bivalve species.

P-105: THE TOXICITY AND EFFECTS OF CARBAMAZEPINE ON DREISSENA MUSSELS (DREISSENA POLYMORPHA AND DREISSENA BUGENSIS) AND YELLOW PERCH (PERCA FLAVESCENS)

Jee Hwan Lee, Melody Bernot

T07: Ecotoxicology

The prevalence of pharmaceuticals in aquatic ecosystems is apparent; however, our understanding of the potential adverse effects of pharmaceuticals on aquatic organisms is limited. We evaluated acute and chronic toxicity of carbamazepine on invasive dreissena mussels and yellow perch. Acute toxicity experiments were conducted over 48 h to quantify response to carbamazepine concentrations across several orders of magnitude. Acute tests quantified a > 20 mg/L LC50 on dreissena mussels and a 19.93 mg/L LC50 on yellow perch. To assess chronic toxicity, dreissena mussels were exposed to 0 - 20 mg/L concentration over two weeks and mussel shell-opening size was measured as a responsive behavior. Carbamazepine exposure at 20 mg/L reduced shell-opening size compared to 0.2 mg/L concentration. Chronic toxicity tests were conducted over 65 d to quantify fish response to environmentally-relevant concentrations of carbamazepine (0 - 12 µg/L). Fish exposure to 12 µg/L resulted in reduced growth measured as lower total body length and weight and altered yellow perch behavior. These data suggest carbamazepine has adverse effects on aquatic organisms at concentrations regularly measured in freshwater ecosystems.

P-106:

Anna Harrison

T07: Ecotoxicology

Sediments in human dominated watersheds are often contaminated with various pollutants, which affect a stream's habitat suitability for organisms. Urban streams are also often channelized and have reduced subsurface interactions with groundwater. The hyporheic flows that occur in streams with connected groundwater-surface water interactions are important natural processes for biota and additionally are shown to process potential contaminants. This research utilizes field experiments to assess the effect of hyporheic flows on contaminant transport and biotic community response. Laboratory-amended contaminated sediments spiked with five concentrations of zinc were placed into streams and over four weeks the concentration of zinc was measured in the sediments. Half of the sediments were connected to hyporheic flows and half were cut off from hyporheic flows. The biotic community response to the contaminated sediments and hyporheic exchanges was measured, using biofilms as the primary indicator. This method allows for a controlled study of hyporheic influenced contaminant transport than using field-contaminated sediments and an improved understanding of how the hyporheic zone regulates contaminant uptake.

P-107: PERSISTENCE OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS FROM WASTEWATER TO LAKE WATER.

Mary Seaman, Todd Miller

T07: Ecotoxicology

Pharmaceuticals and personal care products (PPCPs) are environmental pollutants found in freshwater ecosystems that may have adverse health effects on humans and aquatic organisms. Lake Winnebago, a large eutrophic lake in Wisconsin serves as the receiving stream for multiple wastewater treatment plants, as well as a source of drinking water for over 250,000 residents in four cities. This study sought to identify and track PPCPs in wastewater influent, effluent and lake water. Lake water, wastewater influent and effluent samples were collected June to January monthly and subjected to a solvent extraction using lyophilization and sonication in methanol:acetone:water with 5% acetic acid. Sixty-four PPCPs were quantified using LC-MS/MS. Antibiotics, antimicrobials, and cholesterol-lowering drugs were among the most frequently detected in wastewater influent. A select number of these were found in wastewater effluent and lake water on some sampling days. Results indicate that wastewater treatment strategies do not fully remove all PPCPs and that select groups of PPCPs may persist in lake water. Future work will involve sampling drinking water treatment processes to determine the efficiency of PPCP removal.

P-108: FIRST APPROACH TO ESTABLISHING BACKGROUND TISSUE CONCENTRATION IN MACROINVERTEBRATES OF RIVERS FROM MINING AREAS OF NORTHERN SPAIN

Pilar Rodriguez, Leire Mendez-Fernandez, Isabel Pardo, Odei Barredo, Maite Martinez-Madrid

T07: Ecotoxicology

High concentrations of Cu, Hg and As occur naturally in the sediments of mining districts in the Nalón River basin (Spain). This study is part of a research on metal impact on aquatic biota, including the assessment of metal tissue concentrations in macroinvertebrates and its relationship with impairment in their community structure in the Nalón basin. Background tissue levels of metals were estimated to correctly assess bioavailability and bioaccumulation in impacted areas of the basin. Ten taxa were studied in nine reference sites, comprising different positions in the aquatic food-web (predator, collector-gatherers and scraper-grazers), and considering different metal exposure routes (epibenthic vs endobenthic). There were signficant differences in tissue concentration (µg g-1 dw) between taxonomic groups depending on their feeding behaviour or exposure routes: higher Hg was measured in the sediment-dwelling predator Sialidae [0.19-0.70] and the (non-lumbricid) oligochaetes [0.15-0.62]; higher As in oligochaetes [2.63-16.97], whereas higher Cu in the epibenthic scraper-grazer Heptageniidae [25.48-84.24] and Ephemerellidae [14.85-90.24]. Metal background tissue concentrations reported here are below reported threshold levels in macroinvertebrates, although As and Hg are above reported values from unpolluted sites.

P-109: THE EFFECTS OF CAFFEINE AND PARAXANTHINE ON THE GROWTH, MOVEMENT, AND FECUNDITY OF THE FRESHWATER SNAIL, PHYSA ACUTA

Natalie Abell, Melody Bernot

T07: Ecotoxicology

Caffeine and its metabolites are ubiquitous in aquatic ecosystems, but little is known about potential adverse effects on aquatic organism. The goal of this project was to quantify how caffeine and paraxanthine (a common metabolite of caffeine) affect the growth, reproduction, and behavior of a common freshwater snail, Physa acuta. Specifically, shell length, locomotion speed, number of egg sacs, and total number of eggs were measured in response to environmentally-relevant concentrations of caffeine and paraxanthine. Treatments did not influence snail growth or location. In the first trial, mean snail speed of snails in caffeine and paraxanthine decreased by 29% and 52% respectively. Speed was not affected in the second trial. Snail fecundity decreased with production of egg sacs 38% lower in caffeine and 50% lower in paraxanthine. Egg production was 32% lower in both caffeine and paraxanthine. Because Physa acuta are a keystone species, decreases in fecundity has a potential for altering both producers and consumers dynamics.

P-110: QUANTIFICATION OF THE BIOTURBATION ACTIVITY OF LUMBRICULUS VARIEGATUS WORMS IN FRESHWATER CONTAMINATED SEDIMENTS

Liliana Hernandez, Kevin Roche , Minwei Xie, Aaron Packman

T07: Ecotoxicology

Important biophysicochemical processes occur across sediment-water interfaces. These processes are influenced by bioturbation activities of benthic animals. Bioturbation is thought to be significant in releasing metals to the water column from contaminated sediments, but metals contamination also affects organism activity. Consequently, the aim of this study was to consider the interactions of biological activity and chemical reactions in the understanding of sediment mixing and metals fluxes. We performed experiments using Lumbriculus variegatus worms as the test organisms, and sediments with different levels of zinc contamination from Lake DePue, Illinois. The experiments were conducted in an aerated freshwater chamber. Fluorescent tracers were added to the sediment surface to quantify mixing processes and burrow formation by time-lapse photography. We analyzed the images to obtain the distribution of burrows and fluorescent particle concentrations as a function of depth in the sediments and time. The experiments indicates that bioturbation and sediment mixing was lower in higher contaminated sediments for almost all the time lapse. Therefore, is expected that these processes decrease efflux of metals from highly contaminated sediments by reducing biological activity.

P-111: INVESTIGATION OF PARTHENOGENESIS IN EPHEMEROPTERA AND DEVELOPMENT OF METHODS FOR REARING NATIVE MAYFLY TAXA IN LABORTORY CULTURE

Kevin Rowsey, Mindy Yeager-Armstead Ph.D., Mandee Wilson M.S.

T07: Ecotoxicology

Studies have indicated that elevated dissolved solids in Appalachian streams may negatively impact benthic macroinvertebrates. Specifically, field surveys have shown mayfly population declines in mining regions. However, mayfly sensitivity has not been well corroborated with laboratory testing of surrogate species prompting increased interest in testing with native organisms. Methods were evaluated for rearing field collected mayfly taxa in the laboratory to provide consistently available, healthy organisms for use in toxicity testing. Heptageniidae, Baetidae, Ephemerellidae, Isonychiidae, and Baetiscidae were collected. Additionally, the establishment of a parthenogenetic population would aid in the development of a more sustainable culture. Of the families evaluated, Baetidae was the only family to have exhibited parthenogenesis. Eggs from the genus Baetis had a hatch rate of 46 percent with incubation ranging from 11-29 days after egg collection. Eggs from the genus Pseudocloeon hatched between 17-24 days and had an average hatch rate of less than 1 percent. Several diatom species have been cultured to feed field collected and larval mayflies. Research examining the dietary preferences of mayflies using the different diatom species is ongoing.

P-112: THE EFFECTS OF ELEVATED DISSOLVED SOLIDS ON BENTHIC MACROINVERTEBRATE TAXA

Amanda Chapman, Mindy Yeager-Armstead Ph.D., Mandee Wilson M.S., Jeremy Kinney M.S.

T07: Ecotoxicology

Field-collected benthic macroinvertebrate communities were exposed to a simulated mining discharge representative of Appalachian streams with regards to elevated specific conductance. In 10--day mesocosm tests, specific conductance ranged from 100 µS/cm to 2430 µS/cm. Although all tests were initiated with communities from reference streams, some macroinvertebrate communities exhibited a response to the sulfate dominated discharge while others did not. Evaluation of the individual taxa responses indicate taxa sensitivity to the range of conditions. Within the Ephemeroptera, for example, Baetids were not found above the 600 µS/cm concentration while Ameletus sp. appeared unaffected by the increased dissolved solids. Heptagenia sp. and Maccaffertium sp. were found only at lower conductivity levels while Epeorus sp. and Stenonema sp. showed tolerance to the elevated total dissolved solids. Similar variability was seen in the sensitive orders Plecoptera and Trichoptera and may allow for diverse assemblages to exist under a range of environmental conditions.

P-114: SPATIAL VARIATION IN MERCURY CONTAMINATION OF WHITE SUCKERS: SOURCE TRACKING AND PATHOLOGICAL IMPLICATIONS

Andy Stevens, Dr. Peter McIntyre, Dr. James Hurley, Dr. Vicki Blazer, Dr. David Krabbenhoft, Dr. Evan Childress, Dr. Runsheng Yin, Ryan Lepak, Dan Oele, Ellen Hamann

T07: Ecotoxicology

White suckers (Catostomus commersonii) are widespread, long-lived fish that are targeted in subsistence fisheries and used as sentinels of pollution impacts on the Great Lakes. We surveyed tissue mercury concentrations in white suckers across 12 sites in Lake Michigan, and analyzed tumor incidence from four of them to assess the pathological implications of heavy metal pollution. Mercury concentrations and tumor incidence varied substantially both within and between fish populations. To understand the basis for the observed variation in mercury concentration, we used mercury stable isotopes to differentiate among watershed and industrial inputs of mercury into Lake Michigan. Initial results show differences in mercury signatures of fish residing near similar watersheds. Our work suggest that spatial surveys of both concentrations and isotopes of mercury are important for designing effective control strategies, and may also elucidate the basis for fish pathologies and other ecosystem consequences of contamination.

P-115: EMERGING PHARMACEUTICAL AND PERSONAL CARE PRODUCTS IN AN URBAN ESTUARY

Ame Xiong, Todd Miller, Brian Gayfield

T07: Ecotoxicology

Pharmaceutical and personal care products (PPCPs) are found in rivers, lakes and groundwater with increasing frequency. In addition, the diversity of PPCPs in the market place continues to grow. These chemicals have been found to cause acute and chronic toxicity to aquatic organisms. We sought to identify major PPCPs polluting an urban aquatic environment. We collected samples in six different sites along the Milwaukee River, one of three primary tributaries in the Milwaukee estuary. The water samples were then frozen, lyophilized, and PPCPs extracted with methanol:acetone:water in 5% acetic acid. PPCPs were quantified using liquid chromatography - tandem mass spectrometry (LC-MS/MS) . Of the 57 PPCPs targeted we identified 13 different PPCPs in the Milwaukee River. Caffeine, sulfamethoxazole, thiabendazole, and triclosan were detected at all sites. PPCPs with the highest mean concentrations across sites were caffeine (300 ng/L), and its degradation product paraxanthine (37.6 ng/L), sulfamethoxazole (37.3 ng/L), and thiabendazole (13.3 ng/L). These data indicate that this mixture of PPCPs are most prevalent in this system. Further research is needed to know how this PPCP profile changes over temporal scales.

P-116: EVALUATION OF DECOMPOSITION AND CONSUMPTION TABLETS (DECOTABS) AS A STANDARD SUBSTRATE FOR MEASURING STREAM ORGANIC MATTER DECOMPOSITION

Brent Johnson, Cody Schumacher

T08: Organic Matter Processing

Decomposition and consumption tablets (DECOTABs), consisting primarily of agar and powdered cellulose, have been advocated for use as a standard substrate in measuring organic matter decomposition. DECOTABs have, however, only been tested in the laboratory. We therefore deployed DECOTABs consisting of five different recipes alongside red maple leaves in three streams of different catchment land use type (urban, agricultural, and mixed) for 30 days in autumn 2014. DECOTABs recipes consisted of 60 g/l powdered cellulose and one of the following agar-type/concentrations: 1) 20 g/l purified agar; 2) 20 g/l R2A agar; 3) 30 g/l R2A agar; 4) 10 g/l PhytagelTM; and 5) 20 g/l PhytagelTM. With the exception of negligible red maple leaf decomposition in the urban stream, we found few differences in daily mass loss rate among DECOTAB types or between DECOTABs and red maple. DECOTAB decomposition rates were ca. 100X greater than reported from static microcosms, but were generally consistent among streams and replicates. Faster DECOTAB decomposition rates in the urban stream compared to maple leaves may be due to increased physical abrasion associated with urban runoff.

P-117: DECAY OF LEAVES AND MACROALGAE AND THEIR RELATION TO DETRITAL FOOD WEBS

Megan Grandinetti, Scott Grubbs, Albert Meier, Delaney Rockrohr

T08: Organic Matter Processing

This project is addressing if decaying macroalgae and leaf detritus play a major role in the detrital pool of a 7 th-order karst riverine system. Decay rates and change in carbon and nitrogen isotopic ratios of Cladophora, Platanus occidentalis, and a mix of Acer negundo and A. saccharinum were tracked during summer and autumn in three consecutive years. Packs of air-dried Cladophora, P. occidentalis, and Acer were placed in mesh bags and put in groups (n=4) in wire baskets. Seven baskets were submerged in riffle (20-30 cm) and deeper run (2 m) habitats. Summer Cladophora and Acer decayed significantly faster than Platanus at both depths and across seasons. Platanus had similar decay rates between depths during each season. Seasonality had a strong influence on decay rates, leading to greater mass loss of all three species in the warm summer and fall months compared to the cooler winter months. The implication of rapid Cladophora decay during warm seasons, plus few colonizing macroinvertebrate taxa, is that the decaying macroalgae may pass through only a decomposer food web before being remineralized as CO2.

P-118: IMPACTS OF INCREASED TERRESTRIAL DISSOLVED ORGANIC MATTER ON AQUATIC ECOSYSTEMS

Anne Weaver, Todd Royer, Sirese Jacobson

T08: Organic Matter Processing

Inland waters have been receiving increased amounts of terrestrial dissolved organic matter (DOM) in recent decades. This phenomenon is known as "browning" of aquatic ecosystems and may have effects on chemical, physical, and biological processes of these systems. Because important biogeochemical cycles are dependent on DOM, browning of streams could alter ecosystem processes. We investigated the impacts of three different sources of DOM on sediment microbial activity. We collected DOM leached from forest soil and agricultural soil, as well as a commercial product called "Super Hume", a concentrate of natural fulvic and humic substances. Oxygen consumption via microbial respiration was examined for each of the sources, with and without nitrogen and phosphorus additions, and was not found to be significantly different among treatments. In short-term laboratory assays, denitrification rates were inhibited by the addition of external DOM from all three sources compared to the control, which contained only ambient DOM. Understanding the relationship between increased terrestrial, humic DOM inputs and microbial activity in aquatic ecosystems will allow for improved management of these waters.

P-119: ASSESSING THE IMPACTS OF HUMAN-INDUCED DEGRADATION ON STREAM ECOSYSTEM FUNCTION

Carla Rothenbuecher

T08: Organic Matter Processing

Riparian vegetation provides a plethora of ecosystem services, especially as a source of organic matter critical for many aquatic organisms. Kimball Creek (De Beque, CO) is a severely degraded stream in which loss of riparian vegetation and altered hydrologic regimes may have caused a decrease in litter resources and increased light penetration, inducing a shift from an allochthonous based system to an autochthonous one. These potential shifts in primary productivity and detrital decomposition should directly affect macroinvertebrate diversity as well. In two 100-meter stream reaches with differing levels of disturbance, ash-free dry mass of benthic algae was measured in riffle habitat using ceramic tiles. Litter decomposition was quantified using a leaf pack experiment with two species, box-elder (Acer negundo) and willow (Salix sp.). Algal biomass did not differ significantly between the two sites, whereas box-elder decay rate was higher in the more disturbed reach and willow decay rates were not significantly different between reaches. Future research is needed to further investigate the effects of riparian loss on stream food web and bottom-up pathways in this and other degraded streams.

P-120: DEGRADATION OF PHOSPHATE ENRICHED LEAVES IN ACID MINE IMPAIRED STREAMS VS. UNIMPAIRED STREAMS

Kelly Johnson, Austin Miles, Jared DeForest, Sam Drerup, Morgan Vis, Sophia Phillips

T08: Organic Matter Processing

Leaf litter breakdown is an important source of nutrients for stream food webs, however, phosphate limitation in acid mine (AMD) impaired streams may alter biofilm formation and nutritional quality of litter to shredding macroinvertebrates. We compared breakdown of nutrient enriched and control red maple leaves in AMD impaired and unimpaired streams over two autumns. We also analyzed the macroinvertebrate communities that colonized the litter bags and measured growth rates of caged caddisflies (Pycnopsyche sp) and craneflies (Tipula sp). Samples were collected for biofilm lipid analysis. We found no significant effect of P enrichment on leaf degradation (2013 or 2014) except for an initial increase in degradation in 2013 ($P<0.0001$, $P=0.0168$). This effect was not sustained in later weeks nor was it observed in 2014. There were no significant differences in the abundances of shredders that colonized the bags, or in growth rate of either target species. Analysis of leaf biofilms may reveal more subtle effects of P enrichment, however our findings suggest that phosphate limitation in AMD streams may impact litter breakdown processes less than primary production.

P-121: MACROINVERTEBRATE COMMUNITY ASSEMBLAGES AND LEAF DECOMPOSITION IN THREE RIVER BASINS OF THE SOUTHEASTERN COASTAL PLAIN

V. Byron Collins II

T08: Organic Matter Processing

River systems within the Southeastern Coastal Plain are characterized by low gradients, broad floodplain connections, and limited autochthonous production, and thus derive the majority of their energy from allochthonous sources. The decomposition rate of this organic matter is a function of physical and biological factors. To assess the effects of flow regime, particularly the magnitude of discharge, and colonizing invertebrates on leaf-litter decomposition rates, packs of senesced leaves from Quercus nigra were deployed at six sites across three river basins (Savannah, Ogeechee, Altamaha). A total of 96 leaf packs containing 20g (± 0.15g) were deployed in mid-September 2014 and retrieved at two-week intervals over an eight-week period. During the period of study, we observed average discharges of 150.8, 75.3, and 8.2 m3/s on the Savannah, Altamaha, and Ogeechee, respectively. We predict that decomposition rates will be positively correlated with river discharge, and thus the Savannah will yield the greatest leaf mass losses. Furthermore, we hypothesize that functional composition of colonizing invertebrate communities will also differ among river basins due to variation in physicochemical characteristics of each basin.

P-122: PHYSICAL, CHEMICAL, AND BIOLOGICAL INVESTIGATION OF ACTIVE AND PASSIVE RESTORATION OF CRANBERRY BOG AGRICULTURE IN THE NE COASTAL ZONE OF MASSACHUSETTS

Sean McCanty, Alan Christian

T04: Aquatic Ecosystem

Freshwater systems are among the most managed ecosystems globally, with streams and wetlands being impounded and drained for a multitude of uses. As agriculture diminishes in many coastal watersheds, active restoration of wetland-stream systems promises to improve ecosystem benefits and restore biological integrity. Tidmarsh Farms in Manomet, Massachusetts is a 192-acre former cranberry bog, undammed and in fallow since 2010, awaiting active restoration of the original stream channel and wetland features during summer 2015. We will examine the restoration through 3 lenses: landscape and habitat, biological structure, and stream function. The restoration site will be compared to both a reference and actively farmed system. We expect that baseline comparison data will demonstrate reduced complexity of community structure and food web dynamics in the restoration site and significant differences in habitat and water quality. Evaluating during and after restoration allows us to extrapolate the system's equilibrium state and document the successes and shortcomings of active restoration. Since many of Southern Massachusetts' cranberry bogs are being retired from service, this project has potential to shape policy for future wetland and stream restorations.

P-123: CAN A FATMETER BE USED TO DETERMINE THE SEX OF LAKE STURGEON (ACIPENSER FULVESCENS)?

Dalton Lebeda, Derek Ogle, Glenn Miller, Ryan Koenigs, Tim Haxton

T09: Conservation and Restoration

Lake Sturgeon do not exhibit sexually dimorphic external characteristics. Therefore, the sex of Lake Sturgeon has traditionally been determined via internal examination of gonadal tissue. Recently, several non-invasive methods to determine sex of Lake Sturgeon have been proposed to minimize stress or injury that may cause mortality of the fish. Our objective was to determine if Lake Sturgeon sex can be reliably determined from fat content levels collected in a non-invasive manner with a Distell FatmeterTM. Using the Fatmeter, three lateral and three ventral readings were taken from 71 Lake Sturgeon harvested during the 2013 and 2014 spearing seasons on the Lake Winnebago System. Linear discriminant analysis and logistic regression were used to compare sex determined from Fatmeter readings and through visual observation of gonadal tissue. Combined Fatmeter readings alone accurately predicted sex for 55% of females and 50% of males, meaning Fatmeter readings did not accurately determine sex of Lake Sturgeon harvested during the winter spearing season. Future research may focus on using the Fatmeter during other seasons when frozen tissue would not be a factor.

P-124: EFFECTS OF A COMMON IN-STREAM RESTORATION PRACTICE ON DISSOLVED OXYGEN AND ECOSYSTEM METABOLISM IN A LOW-GRADIENT MIDWESTERN RIVER

Sophia Bonjour, Leighton King, Heidi Rantala, Karen Baumann, Micah Bennett, Matt Whiles

T09: Conservation and Restoration

Newbury rock weirs are used for channel stabilization in many North American river restorations. Previous research in a southern Illinois river found weirs benefit aquatic macroinvertebrate, fish, and riparian bird communities by increasing habitat heterogeneity and insect emergence production. We hypothesized that weirs would also increase dissolved oxygen (DO) through reaeration via turbulence over rocky substrata. We measured DO longitudinally upstream and downstream of a Newbury weir for 48-72 hours (n=3 sampling periods) at ten-minute intervals, using the upstream station as a reference point for estimating weir effects. We used a salt slug to estimate travel time between oxygen sensors, allowing us to calculate DO change between sensors and thus ecosystem metabolism, using a two-station method. Turbulence over the weir increased DO, which was directly related to discharge ($r2=0.99$, $p<0.05$), with 14-34% of the increase due to gross primary production (GPP). GPP tended to vary inversely with discharge, but this relationship was only significant in downstream reaches ($r2=0.99$, $p<0.05$). Results suggest Newbury weirs can be local "hotspots" for reaeration and GPP, particularly during low flow periods.

P-125: POST REMEDIATION AND RESTORATION BIOASSESSMENT OF TWO SMALL SOUTHWESTERN OHIO STREAMS

Marty Sneen, Mary Lou Rochotte

T09: Conservation and Restoration

Dicks Creek and Monroe Ditch are small tributaries in the Great Miami River watershed in southwestern Ohio. As a result of polychlorinated biphenyl contamination, a permitted discharger was required to remediate, restore, and monitor segments of these streams. Remediation efforts, which included the dredge removal and disposal of approximately 174,500 metric tons of sediment and floodplain soils over nearly four miles of stream, were completed in three phases during 2010, 2012, and 2013. Concurrent restoration activities completed in November 2013 involved both instream and riparian improvements. The first year of instream post construction monitoring was conducted during the summer of 2014 at multiple locations upstream, within, and downstream of the restored segments. The fish and benthic macroinvertebrate assemblages as well as aquatic habitat in the restored segments were compared to pre-remediation conditions and upstream reference locations. Substantial improvement was observed in terms of aquatic habitat quality as well as the fish and benthic macroinvertebrate assemblages compared to baseline conditions. As such, these results demonstrate that the remediation and restoration objectives for instream portions of the study segments are being attained.

P-126:

Joelle Laing

T09: Conservation and Restoration

Eutrophication in rivers is often characterized by sharp increases in filamentous algae and sediment organic matter, potentially resulting in highly reduced conditions in river bottom sediments. These reduced sediments may contain phytotoxic compounds which inhibit the growth of native submerged aquatic vegetation (SAV). Conversely, roots of established SAV may increase sediment redox potential by oxygenating the rhizosphere. In this study we measured sediment redox potential at six points in five subtropical spring-fed rivers (n=30). At each point we compared redox potential in sediments high in organic matter with redox potential in bare sediments and in sediments underlying SAV beds. Additionally, we collected plant biomass and sediment samples to investigate relationships between sediment redox potential and its potential drivers. Preliminary results show that sediments high in organic matter had lower redox potential while sediments high in belowground biomass had higher redox potential. These results have strong implications for SAV restoration plantings. Reducing conditions in sites formerly dominated by filamentous algae may cause widespread plant senescence when sediments are not properly prepared for planting.

P-127: IMPACT OF LIME AMENDMENTS ON MACROINVERTEBRATE COMMUNITY DYNAMICS IN ACID-STRESSED ADIRONDACK MOUNTAIN STREAMS

Grant Haines, Wesley Morgan, Randy Fuller, James Paris

T09: Conservation and Restoration

The Adirondack Mountain region of New York State is especially susceptible to the effects of acid deposition and one mitigation strategy is to add pelletized limestone directly to stream channels or across entire drainage basins to neutralize incoming acid. We studied the impact of lime amendments in 5 streams, 2 are chronically acidic, and 3 are episodically acidic. Lime has been annually applied directly into stream channels in 2 episodically acid streams, and in 2013 we aerially applied lime to a whole drainage basin of 1 chronically acid stream. During a leaf decomposition study, we examined macroinvertebrate community dynamics in leaf packs placed in all 5 streams during summer and autumn of 2012 (dry year) and 2014 (wet year). Densities were much higher in leaf packs during summer 2012 as water levels decreased and were much higher overall than in autumn. Diversity was lowest in chronically acid streams in part because of the absence of Ephemeroptera in these streams. While lime applications improved chemistry almost immediately, we have yet to observe any shifts in macroinvertebrate community composition in limed streams.

P-128: REDUCED FLOW INHIBITS STREAM INVERTEBRATE COMMUNITY RECOVERY DURING DROUGHT: IMPLICATIONS FOR RESTORATION AND MANAGEMENT

Scot Peterson, Howard Whiteman

T09: Conservation and Restoration

Restoring and managing degraded streams can be problematic in regions prone to drought. Using recolonization traps, we compared the recovery of invertebrate communities at two sites (Degraded and Reference) along an agriculturally impacted 3rd order stream in western Colorado, USA during two consecutive drought years (2012-2013). When compared to 2012, total abundance was reduced in traps open to upstream sources at both sites in 2013, despite an overall increase in natural community abundance at these sites, suggesting that diminished flow during the second drought year reduced potential colonizing individuals. Total drift abundance at the reference site significantly decreased during the second year of drought, supporting this hypothesis; in contrast, drift abundance did not change at the degraded site. Taxa composition of drifting invertebrates at the degraded site, however, shifted between years and became dominated by small-bodied invertebrates that were extremely rare in recolonization traps in 2013. Our results indicate that invertebrate communities in severely impacted stream reaches recover much slower than those from less degraded ones and reduced flows may inhibit restoration efforts during times of drought.

P-129: IMPACT OF LIME AMENDMENTS ON LEAF DECOMPOSITION DYNAMICS IN ACID-STRESSED ADIRONDACK MOUNTAIN STREAMS

James Paris, Grant Haines, Wesley Morgan, Randy Fuller

T09: Conservation and Restoration

The Adirondack Mountain region of New York state is particularly susceptible to the effects of acid deposition, and a potential mitigation strategy is to add pelletized limestone directly to stream channels or across entire drainage basins to neutralize incoming acid. We studied the impact of lime amendments in 5 streams, 2 being chronically acidic and 3 episodically acidic. Lime has been annually applied directly to stream channels of 2 episodically acidic streams, and in 2013, we aerially applied lime to a whole drainage basin of a chronically acidic stream. We compared rates of leaf decomposition and microbial respiration in streams for both summer and autumn in 2012 (dry year) and 2014 (wet year). In 2012 and 2014, leaf decomposition and microbial respiration rates were lower in chronically acidic than episodically acidic streams, and overall, decomposition rates were higher in summer than in autumn. Also, decomposition rates were higher in summer 2012 than 2014. Lime applications have yet to show increases in leaf decomposition or microbial respiration rates, suggesting that while acidity is decreased, the biotic community is slower to respond.

P-130: BENTHIC MACROINVERTEBRATE COMMUNITY RESPONSE TO LARGE-SCALE LAKE RESTORATION

Melissa Benedict, A. Maria Lemke

T09: Conservation and Restoration

Benthic macroinvertebrates were sampled over a 10-year period to quantify how these communities responded to large-scale restoration of a historical floodplain lake along the Illinois River, Illinois. Thompson Lake is a 6,000-acre backwater lake that was separated from the Illinois River by levees in the early 1920's and subsequently farmed for corn and soybean production. Agricultural pumps were turned off in the spring of 2007 and the area has since been reinundated from precipitation and groundwater sources. Macroinvertebrates were collected using an Ekman dredge from 8-15 sites at approximately 1-month intervals from pre-restoration agricultural ditches (2004-2005), early lake restoration habitats (2008-2009) and 5 years after inundation (2013-2014). Oligochaetes and chironomids were dominant throughout the 10-year period; however, densities of caddisflies, dragonflies, damselflies, Caenis mayflies, and fingernail clams have increased since 2007. Our goal is to estimate invertebrate secondary production during the restoration of Thompson Lake as part of a series of concurrent studies conducted along the Illinois River that address the complexities of restoring and managing floodplain habitats for biodiversity and ecosystem function.

P-131: EVALUATING WETLAND FUNCTION WITH RESPECT TO WATER QUALITY INDICATORS

Subhomita Ghosh Roy

T09: Conservation and Restoration

Anthropogenic land-cover modifications are leading to ecological disruptions and damaging freshwater quality. Sediment microbes are integral to water quality maintenance and wetland function. Critical processes such as the capability to detoxify surface water by trapping and breaking down pollutants in sediments protect the value of natural wetlands. To harness these processes, constructed wetlands have been used for water treatment. My research investigates the ecological functioning of a constructed stormwater pond-wetland system in the urbanizing watershed of the Pike River in Southeastern Wisconsin. The study revealed that the wetlands decrease phosphate, specific conductance, and turbidity, and increase dissolved oxygen from up to down-gradient. Wetland water discharging to the Pike River varies based on season, precipitation and discharge. Significant trends were also found among ecotoxicological responses of sediment toxicity. The patterns suggested that sediments are critical to wetland function. Based on these results, it is assumed that sediment microbes control many wetland functions. Future hypotheses include spatial and temporal variation of microbial genetic diversity across natural and constructed wetlands. To test these hypotheses, bio-indicator assays will be developed.

P-132: IDENTIFYING COOLWATER STREAMS TO ASSESS THEIR VULNERABILITY TO LANDCOVER AND CLIMATE CHANGE IN ILLINOIS

Jodi Vandermyde, Brian Metzke, Leon Hinz Jr.

T09: Conservation and Restoration

Coolwater streams are relatively uncommon in Illinois, but support several species of conservation concern. These streams maintain thermal habitats for a broad array of species so even small changes in temperature could shift stream thermal regimes and impact species distributions and local communities. Coolwater stream reaches were identified using observed temperatures that met a mean daily July temperature threshold of less than 21.5°C or known locations of fish species associated with coolwaters in Illinois (Brook Stickleback, Longnose Dace, Mottled Sculpin). To assess the vulnerability of these coolwater reaches, we are monitoring stream temperature at 31 sites in northern Illinois and developing statewide stream temperature and fish distribution models using existing data. These models will be used to assess the vulnerability (exposure and sensitivity) of coolwater streams to changes in landcover and climate by examining a range of potential conditions. Further analysis will examine how thermal regimes of coolwater streams are influenced by geologic, climatic and landcover characteristics. We will also examine potential changes in fish species distributions and functional isolation of coolwater reaches associated with landcover and climate change scenarios.

P-134: EFFECTS OF CRANBERRY BOG RESTORATION ON PHYSICAL HABITAT, AQUATIC INVERTEBRATE COMMUNITIES, AND ECOSYSTEM PROCESSES AT TIDMARSH FARMS, MASSACHUSETTS

Edgar Franck, Alan Christian, David Kemp

T09: Conservation and Restoration

The River Continuum Concept (RCC) models the expected relationship between in stream biota and the surrounding physical habitat in a pristine forested stream. Global change drivers such as land use land cover (LULC) change influences stream assemblages and ecosystem processes. River restoration can play an important role in counteracting LULC effects. Tidmarsh Farms Study Area (TFSA), including Beaver Dam Brook (BDB) and its surrounding wetland, was actively farmed for cranberries from the mid-1800s until 2010. Passive restoration was implemented in 2010 with a headwater dam being removed and bog going fallow. Active restoration will commence in spring/summer 2015. We established 8 sampling stations along 1st - 3rd order stream reaches of BDB and sampled for physical habitat, physical-chemical water column, benthic macro invertebrates (BMI), and nutrient limitation. Because Beaver Dam Brook is not a forested headwater system, we expected the stream structure and function at TFSA will not follow RCC expectations. By monitoring and assessing the physical, chemical, and biological conditions of TFSA, we will have some picture of the effectiveness of passive and active restoration.

P-135: ASSESSMENT OF 20 YEARS OF ACID MINE DRAINAGE TREATMENT TECHNOLOGIES AND RESULTS IN THE CHEAT RIVER WATERSHED, WEST VIRGINIA

Kevin Ryan

T10: Landuse and Non-Point source Impacts

The Cheat River watershed, spanning 1426 square miles in northern West Virginia (WV), is impacted by non-point source pollution emanating from abandoned coal mines. Acidic mine drainage from these mine lands severely degrades stream health and limits recreation and economic development opportunities in the watershed. Since 1994, Friends of the Cheat (FOC) has worked with partners to implement 17 remediation projects totaling over $7 million in public and private funds. The WVDEP, WVDNR, WVU Water Research Institute, and other partnering organizations have documented 20 years of project and water quality data resulting from various treatment technologies including wetland systems, flushing limestone ponds, and in-stream lime dosing. However, few impaired subwatersheds have achieved Total Maximum Daily Loads and most streams remain biologically impaired. Efforts have been challenged by a lack of space in mountainous areas, limited funding, and the large scope and severity of degraded water quality. FOC and its partners continue to search for new technologies, funding, and prioritization methods to address acid mine drainage in the watershed where conventional funding programs and restoration strategies may be inadequate.

P-136: IMPACT OF NONPOINT SOURCE POLLUTION AND SINGLE EVENT CONTRIBUTIONS ON WATER QUALITY IN SOUTHERN MANITOWOC COUNTY, WISCONSIN, CREEKS

Rebecca Abler, Richard Hein, Mallary Schenian

T10: Landuse and Non-Point source Impacts

Several small streams meander through the southern portion of Manitowoc County, Wisconsin, and empty into Lake Michigan. Each creek affects local lake systems, is a potential source for recreational fishing, and contributes to Lake Michigan water quality and beach closures. Land-use is primarily agricultural, but includes residential and light-industrial areas. We sampled physical, chemical, and biological parameters on five creeks within a 15 mile region during 2012-2014. The study focus, Centerville Creek, underwent a major restoration project in 2012. The four other creeks were included for comparison. Phosphate and E. coli levels are consistently and significantly above acceptable levels. Average total phosphate (TP) and total dissolved phosphate (TDP) were 0.557 mg/l (maximum = 12.270) and 0.398 mg/l (maximum = 7.246), respectively. E. coli levels exceeded 1000 MPN/100 ml in 49.1% of samples. Similar trends across the other creeks indicate regional pollution issues. Large single-day pulses indicate that discrete events, such as rain and disturbances (e.g., construction) contribute to high E. coli and phosphate levels. Management plans should include assessment of multiple sources of runoff pollution as well as single-event contributors.

P-137: STREAM ECOSYSTEM METABOLISM IN URBAN CALIFORNIA COASTAL STREAMS

Heather Frazier, John Melack

T10: Landuse and Non-Point source Impacts

California coastal streams face ongoing pressure from urban land use and provide a setting to compare the resulting ecosystem changes across variably developed watersheds. Dissolved oxygen records were collected between March and August, 2014, in 4 urban and 2 undeveloped Santa Barbara, California streams. The data were used to estimate community respiration (CR), gross primary production (GPP), net ecosystem productivity (NEP), and the ratio of GPP to CR (P/R). Complementary measurements included water temperature, water level, light levels and canopy conditions, hydraulic conditions, benthic algae and organic matter, nutrient concentrations, and dissolved organic carbon levels. GPP ranged from 0.07 to 4.07 g O2/m2/day, CR ranged from 0.09 to 12.50 g O2/m2/day, NEP ranged from -11.67 to 0.34 g O2/m2/day, and P/R ranged from 0.01 to 1.48. The urban sites generally had higher GPP, lower CR, more positive NEP, and P/R closer to 1, indicating more autotrophic conditions than non-urban streams. These results indicate that stream metabolism is sensitive to urban land use and may be a useful indicator of ecosystem alteration in urban areas.

P-138: PATH FLOW ANALYSIS OF PARAMETERS INFLUENCING WATER QUALITY IN THE CHARLES RIVER WATERSHED, MASSACHUSETTS

Laurissa Gulich, Alan Christian

S17: SS: Landscape Approaches to Nutrient and Sediment Management in Streams

Global change drivers such as land use land cover (LULC) within a watershed affect water quality directly and indirectly. By determining independent and dependent variables contributing to water quality, we aim to develop effective management recommendations for the highly urbanized Charles River Watershed for the Charles River Watershed Association. We will fit 2012 and 2013 water quality data from 10 stations within the Charles River watershed sub-basins to an appropriate water quality path flow analysis. Regional, reach, and local scale parameters to be investigated include, but are not limited to, % impervious cover, reach scale LULC and % impervious cover, USEPA habitat assessment scores, physico-chemical concentrations, and benthic invertebrate index scores. We expect to see a direct linkage between land use and impervious cover within each sub-watershed to nutrient supply. Therefore, indicating an indirect correlation between land use and dissolved oxygen, affecting quality of habitat and the biotic index within a reach. We expect our results to contribute to the management of water quality in the Charles River Watershed with the goal to improve water quality.

P-139: LAND COVER INFLUENCE ON MACROINVERTEBRATE ASSEMBLAGES IN MARQUETTE COUNTY, MICHIGAN

Ashley Burtner, Corey Krabbenhoft, Donna Kashian

T10: Landuse and Non-Point source Impacts

Eagle Mine, a newly-constructed copper and nickel mine in Marquette County, Michigan, threatens several streams through deforestation, road construction, and potential chemical contamination. The purpose of this study was to identify correlations between watershed and riparian land covers with macroinvertebrate assemblages of 26 streams surrounding the mine. Biological assessments approximate stream health and represent other variables that are often more difficult to measure, such as watershed disturbance and nutrient availability. The Shannon-Weiner Index and the Hilsenhoff Biotic Index showed considerable variation among streams in biodiversity and tolerance respectively. Watershed and riparian land covers of the focal streams prior to construction had similar ranges and variability between streams, with consistently high proportions of forest (49-100%) and low densities of commercial, residential, and transportation usage (0-3%). Stepwise regressions show watershed land cover to be more strongly correlated with macroinvertebrate indices than riparian land cover. Together this indicates that deforestation and disturbance associated with the mine may affect macroinvertebrate assemblages and stream health along the entirety of affected streams rather than merely locally and further sampling is necessary to monitor continuing effects.

P-140: CHANGES IN WATER CHEMISTRY IN CEDAR CITY IRRIGATION SYSTEMS

Coral Gardner, Donald Long, Fredric Govedich, Paul Spruell

T10: Landuse and Non-Point source Impacts

Irrigation of lawns and gardens in Cedar City, Utah is accomplished in two fundamentally different manners. In older neighborhoods, water is diverted from a natural stream (Coal Creek) into a series of canals for residential flood irrigation, compared to newer neighborhoods, which use sprinklers from well water. The overall objective of this project is to better understand the chemical and biological changes that occur in irrigation and runoff waters in Cedar City. We are addressing the following three hypotheses. 1) Changes will be observed in water chemistry as surface water moves from Coal Creek through Cedar City. 2) Irrigation strategies influence water chemistry during periods of high precipitation. 3) Microbial community changes will be associated with differences in water chemistry. Over the course of four months, there was a reduction in alkalinity levels among all sites. During high precipitation periods, nitrate was detected in newer neighborhoods. Dissolved oxygen and pH were at higher levels, while salinity and conductivity were lower in a reservoir site relative to irrigation canals. Future work will investigate bacterial community composition in Cedar City waters.

P-141: INSECTICIDE CONCENTRATIONS IN STREAMS OF SOY PRODUCTION REGIONS IN SOUTH AMERICA

Lisa Hunt, Carlos Bonetto, Vincent Resh, Daniel Forsin Buss, Silvia Fanelli, Marrochi Natalia, Michael J. Lydy

T10: Landuse and Non-Point source Impacts

Concentrations of 17 insecticides were measured in sediments collected from 48 streams in intensive soy production regions of South America (Argentina in 2011-2014, Paraguay and Brazil in 2013) during peak application periods. Although environmental regulations are quite different in each country, commonly used insecticides were detected at high frequencies in all regions. Maximum concentrations (and detection frequencies) for each sampling event ranged from: 1.2–7.4 ng/g dw chlorpyrifos (56-100%); 1.2–7.4 ng/g dw cypermethrin (20-100%); 0.42–16.6 ng/g dw lambda-cyhalothrin (60-100%); and 0.49–2.1 ng/g dw endosulfan (13-100%). Other pyrethroids were detected less frequently. Banned organochlorines were most frequently detected in Brazil. In all countries, cypermethrin and/or lambda-cyhalothrin toxic units (TUs) based on Hyalella azteca LC50s were occasionally >0.5 (indicating likely acute toxicity), while TUs for other insecticides were <0.5. There was a negative relationship between buffer width and TUs, and 83% of sites with average total TU>0.5 had buffers of <20m. While Brazil and Paraguay require forested stream buffers, there are no such regulations in the Argentine pampas where buffer widths were smaller.

P-142: DETERMINING THE EFFECT OF PHYSICAL CHARACTERISTICS OF URBAN STORM SEWER SHEDS ON WATER QUALITY IN BLOOMINGTON, IL

Alicia O'Hare, Catherine M. O'Reilly, Kevin Kothe, Rex J. Rowley, John C. Kostelnick

T10: Landuse and Non-Point source Impacts

Increasing urbanization has consequences for surface water quality. Stormwater is a large component of urban water degradation that is poorly understood. Precipitation is quickly transported via underground pipes from the land to the stream without following water's natural flow path. Studies have correlated detention ponds with improved water quality and impervious surface cover with degraded water quality. However, other physical characteristics within a storm sewer shed including the presence of sump pumps, area and pipe miles may also affect the stormwater quality. We chose 18 storm sewer systems in Bloomington, IL. We measured pH, temperature, conductivity, dissolved oxygen, chloride, nitrate, phosphate, and total suspended solids. Relationships and differences among the physical characteristics and water quality were determined using correlation and ANOVA analyses. We found that the presence of a pond significantly lowered total suspended solids and the greater the length of pipe system the lower the concentration of nitrate. This research could contribute to how storm sewers are built and retrofitted in the future to decrease the water quality degradation from storm events.

P-143: NATURAL GAS DEVELOPMENT ALLEVIATES NUTRIENT LIMITATION OF ALGAL GROWTH IN FAYETTEVILLE STREAMS

Bradley Austin, Natalia Hardgrave, Sally Entrekin, Brian Haggard, Michelle Evans-White

T10: Landuse and Non-Point source Impacts

Construction of natural gas (NG) infrastructure may negatively influence streams by clearing watershed vegetation and increasing sediments and sediment-bound nutrients. Previous research found a positive correlation between NG development metrics and algal biomass. Total nitrogen (TN) can also relate positively to NG metrics, but no direct correlations between N and algal biomass were found. We used nutrient diffusing substrates (NDS) with +N, +phosphorus (P) and +NP treatments to explore potential NG effects on N- and P- limitation of algal production within 8 streams in the Fayetteville shale region of Arkansas. Algal production in streams with well densities <0.12 wells/km2 was primarily N-limited and was co-limited in one stream. Streams with high NG activity (>0.12 wells/km2) were not nutrient limited. Additionally, algal production from the +N treatments was negatively related to both well density (R2= 0.57; p= 0.03) and background TN (R2= 0.52; p= 0.04). These data provide additional evidence supporting the hypothesis that the mechanism by which NG activity stimulates Fayetteville shale stream algal production is via alleviation of N-limitation.

P-144: FIVE-YEAR TRAIT-BASED COMPARISON OF MACROINVERTEBRATE COMMUNITIES IN FAYETTEVILLE SHALE, ARKANSAS

Lucy Baker, Sally Entrekin

T10: Landuse and Non-Point source Impacts

Forest clearing, infrastructure, and water withdrawal have increased in some catchments across the Fayetteville shale where the number of unconventional natural gas wells (UNG) has increased 50-fold since 2005. Activities associated with UNG could alter stream water quality and biological communities but the extent and duration of disturbance has not been quantified. We compared macroinvertebrate traits likely to reflect UNG disturbances from three streams in catchments with UNG and three without UNG from 2010-2014. We predicted for example, scraper and multivoltine taxa density would increase in response to catchment disturbances that increased chlorophyll a and unstable substrate.There was no difference in taxa densities between UNG and no UNG sites; however, there was a decrease in the density of both traits over time in UNG sites.The preliminary results suggest both sensitive taxa (Stenelmis and Stenonema) and tolerant multivoltine taxa (Acari and Oligochaetes) declined, but the mechanism for decline is not clear.Future analysis will expand the number of UNG sites and analyze more relevant traits that could elucidate a response to UNG, such as rheophily and external gills.

P-145: DOES HYDROLOGY AND ACTIVITY FROM NATURAL GAS DEVELOPMENT INTERACT TO ALTER AQUATIC COMMUNITIES IN SMALL STREAMS?

Sally Entrekin, Bradley Austin, Julie Kelso, Steven Polaskey, Michelle Evans-White

T10: Landuse and Non-Point source Impacts

Land use interacts with hydrology to affect stream water quality and aquatic communities. Annual fluctuations in timing and duration of flow are predicted to mediate aquatic community tolerance to additional exogenous stressors. Dry years, when streams start flowing in winter and dry in late May, are predicted to support more tolerant species in contrast to streams that flow October through July. We measured periphyton biomass and chlorophyll a and macroinvertebrates across 10-15 ungaged streams in spring from 2010-2014 that drain a mix of pasture and forest with active construction of unconventional natural gas wells, pipelines, and roads. Timing and duration of flow varied across-streams and years. Streams wetted from May to July and flowed all year to <5months in a year. Well density and distance of wells to streams were related to greater algae biomass and more tolerant taxa in some but not all sample years. Furthermore, macroinvertebrate taxa related to gas activity differed across streams and years. We will add stream flow statistics to our analysis to examine the effects of hydrology on biological communities in developed catchments.

P-146: EFFECT OF CATIONS ASSOCIATED WITH NATURAL GAS DRILLING ON ALGAL GROWTH

Natalia Hardgrave, Bradley Austin, Sally Entrekin, Brian Haggard, Michelle Evans-White

T10: Landuse and Non-Point source Impacts

Improper storage and disposal of hydraulic fracturing fluid used to extract unconventional natural gas (NG) can result in this material entering nearby streams. Previously, cations associated with fracturing fluids were found to be positively related to both NG development and algal biomass; however, this may have confounded the positive relationship between algal biomass and total nitrogen. By using nutrient diffusing substrata (NDS) with treatments of +K, +Na, +NPK, and +NPNa we discerned effects of cations alone and paired with nutrients on algal growth in streams. NDS were deployed into 8 streams with varying NG development over a period of 2 weeks and then were collected and the glass discs were analyzed for chorophyll ?. While treatments containing N and P amendment had a positive effect on algal biomass in minimally impacted systems, neither cation promoted algal production in any of the sites ($p>0.05$). This suggests that the cations associated with NG activity do not promote algal biomass, and that other mechanisms such as nitrogen amendment are responsible for increased algal biomass in NG-impacted streams.

P-147: QUANTIFYING LONGITUDINAL PATTERNS IN STREAMS THAT TRAVERSE ABRUPT RIPARIAN BOUNDARIES

Scott Mcleay, Rafael Feijó de Lima, Eduardo F. Silva-Júnior, Leonardo Kleba Lisboa, Thomas Heatherly, Eugenia Zandona, Flavia Tromboni, Timothy Moulton, Steven Thomas

T10: Landuse and Non-Point source Impacts

Differences between forested and pasture streams are commonly described in the literature. Yet, relatively little is known about how quickly conditions change as streams cross riparian boundaries, whether variables change at different rates, and factors influencing these patterns. We quantified changes in canopy cover, ammonium, SRP, epilithon, benthic detritus and substrate in a stream that traversed an abrupt forest-riparian boundary in the Atlantic Rainforest of Brazil. Specifically, we quantified conditions at 15 locations in a second-order stream. All sampling locations were spaced 75m apart with the first five locations located above the forest-pasture boundary. We used non-linear regression to estimate average forest and pasture conditions and rate at which stream conditions transition. The direction, magnitude, and rate of change differed among variables. For example, canopy cover reached mean pasture levels within 100 m of the forest boundary, while epilithic chlorophyll a increased more slowly through the pasture, reaching 95% of the expected pasture condition after 750m. We discuss the implications of these results for managing riparian land use and designing restoration activities.

P-148: STABLE ISOTOPES OF ALGAE AND MOSSES REFLECT NITROGEN SOURCES ACROSS MONTANE TO URBAN STREAM GRADIENTS

Simone Jackson, Steven Hall

T10: Landuse and Non-Point source Impacts

Semi-arid streams that flow from montane to urban regions receive multiple anthropogenic nitrogen (N) sources that can potentially be traced across spatial gradients using analysis of their stable isotope ratios (&delta15N). Algae and mosses use stream N, and analysis of &delta15N of their tissues provides an alternative to frequent water sampling. We analyzed &delta15N values of mosses and algae from five streams along the Wasatch Mountain Front in Salt Lake City, Utah to determine if land use differences affected stream N sources. We found that urban stream reaches had greater average values (&delta15N=4.4 ‰) relative to montane stream reaches (&delta15N=1.2 ‰); the presence of dogs and septic systems also increase &delta15N. However, moss and algae &delta15N values consistently differed by an average of 3.3‰, suggesting that mosses and algae at the same sites obtain nitrogen from different sources. We conclude that algae (and mosses to a lesser extent) provide a sensitive identifier of N source variation to inform watershed management, given that consistent differences in algal &delta15N values were observed within and among streams in correlation with land use differences.

P-149: LIGHT AND TEMPERATURE INTERACT TO REGULATE THE RESPONSE OF ALGAE AND HETEROTROPHIC BACTERIA TO ELEVATED NUTRIENT LEVELS IN A BOREAL PEATLAND

Lily Gu, Kevin Wyatt

T11: Algae and Primary Production

Climate change is expected to raise water temperatures, increase nutrients, and cause brownification of aquatic ecosystems in northern latitudes, including peatlands. To evaluate these effects on algae and heterotrophic bacteria, we manipulated light (40, 70, 80 and 95% reduction of ambient), nutrients (nitrogen, phosphorus), and temperature (ambient, warmed) in a factorial design using nutrient diffusing substrates inside warming chambers in an Alaskan peatland. After 10 days, no effect of warming on algal or bacterial abundances occurred in the absence of nutrient enrichment. Algal production and bacterial biomass were significantly elevated by nutrients, independent of warming. Compared to ambient temperatures, warming significantly enhanced the effect of nutrient enrichment on algal and bacterial abundances. Reduction in ambient light of 40, 70, 80 and 95% reduced algal and heterotrophic parameters by approximately 30, 50, 80 and 90%, respectively. Our results indicate that warmer temperatures and nutrient enrichment will elevate algal and heterotrophic metabolism in northern peatlands, but the magnitude of increase will depend on the extent of reduced light levels associated with increased inputs of terrestrial dissolved organic matter associated with climate change.

P-150: EFFECTS OF NUTRIENTS AND TEMPERATURE ON THE RELEASE OF DISSOLVED ORGANIC CARBON FROM THE BENTHIC MACROALGA CLADOPHORA GLOMERATA IN AN INDIANA STREAM

Matthew Stillwagon, Ian Davison, Kevin Wyatt

T11: Algae and Primary Production

Dissolved organic carbon (DOC) released by algae serves as an important source of carbon for heterotrophic bacteria in aquatic ecosystems. We evaluated the influence of dissolved nutrients and temperature on the release of DOC by the benthic macroalga Cladophora glomerata in an Indiana stream. Algal material was collected in January, May, and July 2014, representing periods of low, high, and moderate dissolved nutrients, and exposed to a temperature range between 5? and 30?C (5? intervals) for four days. Nutrients had a stronger effect on Gross primary productivity (GPP) and DOC release, with temperature playing a role within each nutrient treatment. Primary productivity peaked at 15?C and 20?C and decreased thereafter in all seasons and was positively correlated to nutrient concentrations. The rate of DOC release peaked in all seasons at the temperature from which the algae were collected, and was inversely related to productivity at low nutrient concentrations. This work will add to our understanding of how anthropogenic eutrophication and changes in temperature due to global climate change will affect stream ecosystems.

P-151: DIATOM ASSEMBLAGES ON TURTLE SHELLS

Shelly Wu, Elizabeth Bergey

T11: Algae and Primary Production

Turtles have epibiotic algae on their shells, but it is unknown how the behavior of turtles influences epibiotic diatoms. The purpose of this study is to characterize diatom assemblages on turtle species based on shell roughness and behaviors such as basking. We brushed the shells of turtle specimens from natural history collections at the Sam Noble Museum of Natural History (Oklahoma) and the Field Museum of Natural History (Illinois). Turtle species sampled included the common snapping turtle, red-eared slider, and the false map turtle. The diatoms on preserved turtle specimens were not very abundant. Diatom assemblages differed among turtle species. Luticola goeppertiana was the most commonly found species.

P-152: THE EFFECT OF SOLVENT TYPE ON CHLOROPHYLL-A REACTION KINETICS: IMPLICATIONS FOR THE ANALYSIS OF AQUATIC SAMPLES

W. Breck Bowden, Samuel P. Parker, Michael Flinn

T11: Algae and Primary Production

Acetone and ethanol are two common solvents used in the analysis of chlorophyll-a. Numerous studies have discussed the efficiency of each solvent to extract pigments from algal cells, but the effect of solvent type on subsequent analytical steps has not been well documented. For example, the acetone used in "Standard Methods for the Examination of Water and Wastewater (10200H)" is frequently substituted with ethanol on the assumption that these two solvents will behave similarly. In this experiment, we compare the kinetic spectral response of acetone and ethanol extracted pigments following acidification to test this hypothesis. We extracted chlorophyll from spinach leaves and periphyton samples using common acetone and ethanol extraction methods. Extracted pigments were acidified with one of four acid treatment conditions and chlorophyll-a concentration was monitored with continuous spectrophotometric readings. Acetone extracted chlorophyll-a did not vary in response to acid concentrations and remained stable, while ethanol extracted chlorophyll-a was highly variable over time and dependent on acid concentration. We propose a revised method when using ethanol as an extractant, to ensure accurate, repeatable results for future analyses.

P-153: SEASONAL AND SPATIAL VARIABILITY IN PHYTOPLANKTON OF MESOTROPHIC LAKE BEMIDJI, NORTHCENTRAL MN.

Richard Koch, Jefferson Shaw, Dina Janke, Nathaniel Martin, Claire Hansen

T11: Algae and Primary Production

Phytoplankton communities were assessed for seasonal and lateral variability in mesotrophic Lake Bemidji, Beltrami County, MN. Surface water was collected weekly from May-Oct 2014 following a 3x2 design with 3 locations (depth 18-20m, depth 12 m and littoral 5m) in each of the 2 main lake basins. Algal biomass demonstrated bimodal pattern at all sites with slight peaks (c.a. 5 ug Chl/L) in early May following ice-off, then rapid declines in June, increasing to maximal levels (c.a. 50 ug Chl/L) as water temperatures peaked in July. Algal biomass and densities were greatest in littoral zones. Taxa from major groups were present throughout samples, though variations in taxa dominance followed patterns typical, but delayed, for temperate lakes. Diatoms (Synedra, Fragellaria, Asterionella) were dominant early, giving way to Chlorophytes (Chlorella, Odogonium) and Cyanobactera (Nostoc, Anabaena, Aphanocapsa) as nutrients levels declined and surface water temperatures increased. Autumn experienced episodic blooms of Cyanobacteria and Chlorophytes, then dominance by diatoms as cooling temperatures increased vertical mixing. Diatoms (esp. pennate species) persisted in littoral zones throughout much of the sample period.

P-154: EFFECTS OF PHOSPHORUS ASSIMILATION ON LEAF LITTER DECOMPOSITION AND ASSOCIATED BIOFILM

Scott Hamby

T11: Algae and Primary Production

Human activities have caused increased stream nutrient concentrations that can cause changes in detrital biofilm communities. These changes may affect detrital decomposition rate, quality as a food source, and stoichiometric elemental ratios. This study focused on the effects of light (High- 23.2% ± 0.7 Low- 9.1% ± 0.3) and phosphorus (P) concentrations (10,100, and 500 Âµg/L) on the algal communities on the detritus. We found that periphyton growth was dependent on light rather than P concentrations ($F= 3.44$, $p= 0.0479$). Total litter mass loss was positively affected by P concentration ($F=10.3$, $p<0.001$) and negatively affected by light ($F=6.1$, $p=0.02$). Future efforts will quantify fungal biomass and elemental composition across these treatments.

P-155: SHORT-TERM RESPONSE OF ALGAL COMMUNITY STRUCTURE TO PHOSPHORUS PULSES

Gabrielle Costello, Keith Kinek, Steven Francoeur, Steven Rier

T11: Algae and Primary Production

The importance of phosphorus within stream ecosystems as a limiting nutrient to algal communities is well-recognized. However, the response of these communities to non-steady state pulses and varying concentrations of phosphorus, such as those experienced during flood events, is less understood. We investigated the effects of phosphorus pulse duration (0 hours to continuous, 250 µg/L concentration) and concentration (0 to 250 µg/L concentration, 2 hour duration) on algal taxon richness and diversity through the use of artificially recirculating stream channels. Post-exposure algal samples taken from these channels were enumerated and identified microscopically. Our results showed showed a slight negative correlation of taxon richness and diversity to the duration of P pules, but no relationship between the presence of individual taxa and either treatment condition, suggesting that observed responses in P content and physiological performance were due to altered performance of taxa, rather than large shifts in taxon composition.

P-156: CHARACTERIZING AND FIELD TESTING A LOW-COST LIGHT INTENSITY SENSOR

Timothy Schierenbeck, Matthew Smith, Todd Miller

T11: Algae and Primary Production

In aquatic environments light intensity and distribution play a key role in determining and characterizing primary productivity, ecosystem dynamics, and overall water quality. By utilizing inexpensive technologies and intercalibration techniques, light intensity sensors may lead towards a more accurate and precise monitoring of the underwater light field. A low-cost custom light sensor was built and tested against commercially available light sensors on a research cruise in October 2014 from the inner harbor to the open water of Milwaukee Bay, Wisconsin. The light sensing chip was cosine corrected using a light diffusing plastic disc and controlled with an Arduino microcontroller, and cast to a maximum depth of 15.5 meters. Light intensity readings from 5 sampling sites showed that the response pattern of the custom sensor correlated strongly with the responses of both an Onset HOBO light logging pendant and a Biospherical photosynthetically active radiation (PAR) sensor. The custom sensor offers a highly programmable platform to measure light underwater, log data remotely, and record light measurement readings through red, green, and blue filtered channels.

P-157: THE EPIPSAMMIC DIATOMS OF THE LAKE SUPERIOR WAVE ZONE

Leon Katona, Mac Strand

T11: Algae and Primary Production

Littoral zones of very large lakes are characterized by nearly constant wave action and minimal macrophyte growth. Although relatively little is known about primary productivity in these wave zone habitats, it is presumably dominated by microalgae that attach to mineral substrates. In this study, we assessed the abundance, productivity, and community composition of epipsammic diatoms in river mouth and beach habitats along the south-central coast of Lake Superior. Although diatom cell counts were similar across habitats, chlorophyll a concentrations were more than three-fold greater in river mouths than in beach sites. River mouth assemblages were also more species rich than beach assemblages. Although a few species common to all sites dominated the epipsammic production base, habitat specificity was evident for 19 percent of the beach species and 14 percent of the river mouth species. These results suggest that sandy river mouth and beach wave zone habitats are biologically distinct and that river mouths are productivity hot spots in sandy wave zone environments.

P-158: DEVELOPING AN AUTOMATED IN SITU MICROCYSTIN DETECTION SYSTEM

Maureen Thompson

T11: Algae and Primary Production

Harmful algal blooms (HABs) are becoming an increasingly large problem throughout the world. One negative impact of HABs is that many produce microcystin, an algal toxin that can lead to liver failure in humans and other organisms. The World Health Organization has set a limit of 1 µg/L for microcystin in drinking water; therefore, a detection system to provide early warning is needed for this toxin. An automated in situ detector for microcystin is being developed that is capable of reliable, unattended monitoring. Methods for derivatization of microcystin for fluorescent detection are being examined. Derivatization with 4-(1-Pyrene)butanoic acid hydrazide (PBH) is one possible method. The proper formation of the MC-PBH derivative has been confirmed with mass spectrometry. Chromatography and subsequent fluorescent detection is used to purify, concentrate, and detect the MC-PBH derivative. This detector will be an excellent resource for making informed public health decisions, improve potable water quality, and aid in examining microcystin dynamics during HAB events.

P-159: VALUABLE INGREDIENTS AND FEED TOXICITY EVALUATION OF MICROCYSTIS AERUGINOSA ACIDOLYSIS PRODUCT IN MICE

Shiqun Han

T11: Algae and Primary Production

This research studied the extraction of feed ingredients from Microcystis aeruginosa using hydrochloric acid method as a potentially valuable protein resource from eutrophic lakes. Amino acid composition, residual algal toxins and heavy metals of the acidolysis product were studied. After 18h hydrochloric acid treatment, the product of M. aeruginosa contained 17 amino acids, 51.34% of total amino acid requirements, and 30.25% of the livestock and poultry essential amino acid. The residual microcystin-LR was 0.94 µg/kg, which was less than WHO drinking water limit of microcystins. The removal rate of microcystins was higher than 99.99% during the process of hydrolysis. The concentration of heavy metals of the product was in compliance with feed standards. Furthermore, Half lethal dose LD50 of acidolysis product in mice was >9.09g/kg body weight, belonging to actually non-toxic grade. The results of both micronucleus test and sperm shape abnormality test were negative. Animal acute toxicity tests indicated that the acidolysis product of M. aeruginosa was safe to be used as a feed ingredient.

P-160: MEASURING THE BIOTIC INTEGRITY OF MIDDLE FORK JOHN DAY RIVER, OR WITH RESTORATION

Robin Henderson, James Pratt

T12: Bioassessment

Aquatic ecosystems can be monitored using biotic indices, and one of the most commonly used indices is the Observed/Expected (O/E) ratio. To determine if the Middle Fork John Day River (MFJDR) sites (n=10) have improved biotic integrity scores following restoration, we developed random forest (RF) models using macroinvertebrate assemblage data from the Oregon Department of Environmental Quality (ODEQ) representing 105 reference sites and 442 test sites with the River Invertebrate Prediction and Classification System (RIVPACS) framework. The best performing model, based on model performance metrics, was chosen to test that the MFJDR sites have improved biotic integrity scores. The selected RF model predicted that 73% were in most disturbed and 27% in moderately disturbed condition in 2009 compared to 67% in most disturbed, 18% in moderately disturbed, and 18% in least disturbed biological condition in 2013. However, results indicate that there is not yet evidence of significant improvement in biotic integrity scores for restored MFJDR sites. Ongoing analysis is needed to characterize the variability of the macroinvertebrate community and to determine how management actions have affected O/E scores.

P-161: FURTHERING NUMERIC NUTRIENT CRITERIA DEVELOPMENT: A PERIPHYTON STRESSOR-RESPONSE METHOD COMPARISON STUDY

Ashley Rodman, Thad Scott

T12: Bioassessment

Due to increasing eutrophication of surface waterbodies and lack of non-point source pollution regulation, the United States Environmental Protection Agency (USEPA) charged states and tribes with developing and enforcing numeric nutrient standards by 2003. To date, development of numeric nutrient criteria has been hindered, partly due to lack of knowledge about proper data collection methodologies. USEPA guidance for developing numeric nutrient criteria for streams and rivers using stressor-response relationships was released in 2010 and many states continue to struggle with methodological limitations. The objective of this study was to compare two common periphyton-sampling methodologies, which are currently being used in the southern Ozarks to aid in furthering numeric nutrient criteria development using stressor-response relationships. Both methodologies were used to collect seasonal periphyton data from seven Ozark streams with similar biological, chemical, and physical characteristics. Results from each method were statistically compared using paired t-tests. Results from three seasons of sampling will be presented and another three seasons of data will be collected in the future as part of this ongoing study.

P-162: EFFECTS OF STORMWATER RUNOFF ON EPT METRICS IN URBAN STREAMS OF THE KANSAS CITY METROPOLITAN AREA, USA

Barry Poulton

T12: Bioassessment

Over the last three years, we evaluated macroinvertebrate communities in streams within the Kansas City metropolitan area utilizing Missouri bioassessment protocols. Trends in richness and abundance of EPT (Ephemeroptera, Plecoptera, Trichoptera) were compared at rural control, urban reference and stormwater-affected sites across gradients in land use, habitat quality and stormwater volume. During spring 2012-2014, urban stormwater sites had significantly lower richness than control ($p = 0.007–0.0013$) and urban reference sites ($p=0.001–0.021$). Abundance of EPT at urban stormwater sites was significantly lower than control sites during all years ($p=0.008–0.014$) and urban reference sites for two of three years ($p=0.053–0.001$). Mean EPT abundances ranged between 0.6%–10.3% at urban stormwater sites, and exceeded 18% at control sites. Temporal trends indicate only control and urban reference sites consistently meet fully-supporting impairment status based on overall biotic condition scores, and no study sites currently meet regional expectations for EPT metrics. Results support current efforts to develop biocriteria for additional bioassessment metrics in order to augment the effective management of urban streams.

P-163: APPLICATIONS OF REGIONAL MONITORING NETWORK (RMN) DATA, BOTH NOW AND IN THE FUTURE

Jennifer Stamp, Jonathan Witt, Britta Bierwagen, Anna Hamilton

T12: Bioassessment

The United States Environmental Protection Agency (U.S. EPA) has been working with its regional offices, states, tribes, and other organizations in the Northeast, Mid-Atlantic, Southeast and Midwest to establish regional monitoring networks (RMNs) at which biological, thermal, and hydrologic data are being collected from freshwater wadeable streams to quantify and monitor changes in baseline conditions, including climate change effects. RMN surveys build on existing bioassessment efforts, with the goal of collecting comparable data that can be pooled efficiently at a regional level. In this poster we highlight examples of how RMN data are being utilized by biomonitoring programs, which includes: detecting temporal trends; investigating relationships between biological, thermal, and hydrologic data; exploring ecosystem responses and recovery from extreme weather events; testing hypotheses and predictive models related to climate change; and quantifying natural variability.

P-165: NATIVE UNIONIDAE MUSSELS IN THE GLACIATED PLAINS, SOUTH DAKOTA

Kaylee Faltys, Nels Troelstrup

T12: Bioassessment

Native freshwater mussels (Unionidae) are among the most threatened freshwater groups in North America, with 71% of all North American species considered endangered, threatened, or species of special concern. The objective of this study was to assess the distribution and abundance of unionid mussels from streams in the Glaciated Plains. Survey sites (n=100) were proportionately and randomly divided among major river basins of eastern South Dakota and restricted to wadable streams and rivers. Timed searches (2 person hours) were conducted to survey living and dead mussel occurrence, relative abundance, and species composition. Mussels were observed from all major river basins, but occurred at 59% of surveyed sites. Living mussels were encountered from 34% of surveyed sites. We encountered 15 species, which is a decline from the 33 species found in historical state surveys. The James River basin had the highest species richness and abundance. Pyganodon grandis was the most frequently encountered and most abundant. Results of this effort suggest a 54% decline in species richness and greater dominance of a habitat and fish host generalist species relative to historical records.

P-166: THREE AXES OF VARIATION AFFECTING BIOMETRICS SCORES IN A NON-IMPAIRED REFERENCE STREAM

Katelin Shields, Joseph Schiller

T12: Bioassessment

Establishment of regional reference streams is an effective way of assessing impairment of other ecologically similar streams. Though reference streams are necessarily the least impacted, they are not insulated from seasonal and yearly weather fluctuations or changes in surrounding land use. We examined the results of seven macroinvertebrate collections made over a 34 year period at Crabapple Creek, a Tennessee first order ecoregion reference site, to better understand the possible changes in macroinvertebrate community structure and associated bioassessment metrics within an established reference stream. We focused on three axes of variation: inter-reach, seasonal, and inter-annual. Overall multimetric scores ranged from a low of 34 to a high of 42, indicating no impairment. However, the average number of individuals collected and individual biometrics scores varied widely, though less inter-reach variability was observed compared to seasonal or inter-annual. Variation in reference stream biometrics scores indicates changes in community structure that are not readily apparent when a stream continues to be designated as "not impaired."

P-167: UNIONID MUSSELS AS BIOINDICATORS IN AN URBAN STREAM

Annie Harris, Jennifer Slate

T12: Bioassessment

Unionid mussels have great potential to be used as biological indicators of the health of rivers and streams. Juveniles and adults are sedentary, live for many years, and leave shells that provide a historical record. Because they burrow in sediment and are filter feeders, they are affected by both habitat degradation and water quality. Thus, we assessed unionid mussels at two forest preserve sites in an urban stream, the north branch of the Chicago River. We applied the Mussel Conversation Index developed by the Illinois Department of Natural Resources, which classifies streams according to species richness and abundance of unionid mussels. The sites ranked in the two lowest categories (restricted and limited) of the five possibilities in the index. However, live and relic specimens of Lasmigona complanata (white heelsplitter) and Pyganodon grandis (giant floater) were common. With over half of North American species considered endangered or threatened, unionid mussels are arguably the most imperiled group of freshwater organisms, so their presence in an urban stream is encouraging.

P-168: A COMPARISON OF MACROINVERTEBRATE ASSEMBLAGES, FROM 2011-2013, IN THE MARCELLUS SHALE REGION OF THE SUSQUEHANNA RIVER BASIN

Luanne Steffy

T12: Bioassessment

In 2010, the Susquehanna River Basin Commission established the Remote Water Quality Monitoring Network. This program aims to provide real-time continuous water quality data for streams potentially affected by unconventional gas well drilling in the Marcellus Shale region of the Susquehanna River Basin. The network has expanded to include benthic macroinvertebrate sampling as a bioindicator of potential impacts from unconventional gas drilling activities and related infrastructure or other anthropogenic influences. Initial results from data collected annually at 58 sites from 2011-2013 show consistent patterns in macroinvertebrate assemblages across ecoregion, drainage area, and land use, which are independent of degree of Marcellus gas well development upstream of the sampling site. The impacts of an unusually wet year in 2011 may be reflected in the macroinvertebrate communities as samples from 2011 are notably different than samples at the same sites in subsequent years across the entire sampling region.

P-169: DIATOM TYPOLOGY BASED ECOLOGICAL ASSESSMENT OF RIVERS AND STREAMS IN USA

Tao Tang, Jan Stevenson

T12: Bioassessment

Regional studies have shown that stream typologies and site-specific models can improve diatom assessments of rivers and streams by accounting for natural variation within ecoregions. In this study we evaluated improvement in diatom assessments for the USEPA's National Rivers and Streams Assessment using a nationwide reclassification of rivers and streams that accounts for natural variability in diatom assemblages in reference conditions. All the reference sites were clustered into seven groups based on diatom community composition by using a novel model based cluster method. Seventeen variables that reflect natural variability in climate, geology, hydrology, watershed characteristics, and geographical locations were used to discriminate stream types by using random forest analysis, in which elevation, longitude, maximum air temperature and annual precipitation contributed significantly. The variation in multimetric indices (MMIs) at reference sites had lower median values and narrower ranges within stream types based on cluster and random forest analysis than on ecoregions. We conclude that this reclassification has reduced natural influence on MMIs, and a tighter relationship between MMIs and human disturbance may be observed in the future study.

P-170: MACROINVERTEBRATE AND DIATOM ASSEMBLAGES AS INDICATORS OF WATER-QUALITY CONDITIONS IN CONNECTED WETLAND DEPRESSIONS WITHIN THE MISSISSIPPI ALLUVIAL PLAIN

Jennifer Bouldin, Billy Justus, David Burge, Jennifer Cobb, Travis Marsico

T12: Bioassessment

Biological assessment methods that are frequently used for flowing waters have not been established for most types of wetlands within the Mississippi Alluvial Plain. This study evaluated biological metrics and indices utilizing macroinvertebrate and diatom assemblages for their ability to indicate water-quality conditions in connected depressions in the Cache River Watershed in northeastern Arkansas. This particular type of wetland has wide spatial extent within the Mississippi Alluvial Plain. Macroinvertebrate and diatom metrics and indices were compared to a water-quality disturbance gradient that was calculated using specific conductance, pH, and NO3-N data. Four metrics with strongest correlations to the disturbance gradient were selected for both assemblages. Scores for both indices (which combined metrics) decreased in relation to disturbance gradient score. The macroinvertebrate index had a correlation of (rho = -0.71) to the disturbance gradient while the diatom index had a similar correlation (rho = -0.64). These results indicate that biotic indices can be used for monitoring water-quality disturbance in wetlands in the Cache River watershed and for some wetland types within the Mississippi Alluvial Plain.

P-172: OFF-CHANNEL HABITATS OF THE PATOKA RIVER, INDIANA

Mario Minder

T13: Population and Community Ecology

Seventeen miles of the Patoka River in southwestern Indiana were dredged and straightened in 1921 with the goal of draining 100,000 acres of virgin forest for farmland. The three year project was ineffective with frequent flooding annually, caused largely from backwater from the Wabash River. Floodplain habitats are essential for ecosystem functioning in lowland rivers where predictable floods are part of the natural flow regime. Maintaining floodplain habitats allows recurrent connections with the mainstem to permit colonization and prevents sediment filling. These off-channel habitats provide habitat for diverse fish assemblages. We visited 11 oxbow habitats in the Patoka River watershed in 2014. Fishes were sampled by backpack electrofisher and tote-barge electrofisher. We summarize our results with ordinations to describe fish assemblage responses to habitat variation.

P-173: SCALING SPECIES RICHNESS OF INVERTEBRATE COMMUNITIES IN AN ARCTIC WATERSHED USING RAREFACTION

Derrick G. Jent, Michael Flinn

T13: Population and Community Ecology

An accurate estimation of species richness is a necessary but challenging component of determining community structure at many spatial scales. Variation in sampling effort, randomization techniques, and statistical analyses can result in biased estimates of species number. Rarefaction curves offer a robust method to compare species richness. We used rarefaction to compare species richness to assess benthic macroinvertebrate communities within Oksrukuyik Creek, an Arctic watershed in northern Alaska. We compared community structure between intensive (small scale/riffle) and extensive (large scale/reach), as well as between lake and lakeless districts within the stream network. Generally, patterns of small scale species rarefaction curves showed no significant differences. Initial results show significant differences ($P<0.05$) between diversity in lake and lakeless districts and that sampling efforts did not result in similar species rarefaction curves. Comparisons of rarefaction curves between intensive and extensive samples will provide a framework to help us understand how aquatic invertebrate richness, diversity, and patchiness change at multiple scales. The Arctic offers the opportunity to examine ecological scale within the context of relatively simple invertebrate communities.

P-174: EPIPHYTIC DIATOM COMMUNITY STRUCTURE IN A KARST RIVERINE SYSTEM

Greg Barren, Scott Grubbs, Albert Meier, Ouida Meier

T13: Population and Community Ecology

The goal of this study was to assess the epiphytic diatom community structure on Podostemum ceratophyllum along a karst gradient in the upper Green River, Kentucky. Percent cover of P. ceratophyllum and epiphytic density and diversity were quantified along transects within four study reaches. Two upstream reaches were nested in a siliciclastic-carbonate landscape. The two downstream reaches were located in a carbonate-dominated landscape. Twelve genera have been identified with the majority being Cocconeis (94%). The second most abundant genus was Achnanthes (2%). The density and diversity of epiphytic diatoms increased significantly longitudinally along the karst gradient. The two reaches that had the greatest density and diversity were located furthest downstream in the highly karstified reach. There was an overall positive linear relationship between diversity and water velocity. This relationship was evident within and between study reaches except for the most upstream reach where this relationship was reversed. There was no relationship between density and water velocity within or between reaches. Overall, these results demonstrate that certain features of epiphytic diatom communities are influenced by hydrology and karstification.

P-175: "TRUCE WITH NEUTRAL THEORY" REVISITED: ARE SMALL, HIGH-GRADIENT STREAMS DIFFERENT?

Brian Shelley

T13: Population and Community Ecology

Hubbell (2001) presented a united neutral theory of biodiversity where communities assembled by ecologically equivalent individuals all part of a regional species pool. Dispersal is key, though others suggest that in streams, local environmental conditions also influence communities. The purpose here was to evaluate whether local environmental conditions and dispersal may together explain assembly of invertebrate communities. Macroinvertebrates were sampled and habitat variables measured in 8 sites in high-gradient streams in the White Mountains, Maine and New Hampshire, U.S.A. Matrices of similarities between sites (Bray-Curtis), including for predictor variables (distance between sites, habitat variable), were extracted, and associations between matrices explored using Mantel tests. Relationships between matrices were weak and never significant (e.g., Mantel test between invertebrate abundance and distance between sites, $r = 0.199$, $p = 0.106$, habitat variables, $r = 0.279$, $p = 0.059$, and habitat variables + distance, $r = 0.285$, $p = 0.053$). In high-gradient streams, neither dispersal, and/or local environmental conditions explain patterns of diversity. Results suggest a stochastic element to community assembly, complicating our ability to predict changes in diversity due to various stressors.

P-176: LEAF LITTER QUALITY, NOT LOCAL ADAPTATION OF STREAM MACROINVERTEBRATE COMMUNITIES, DRIVES LEAF DECOMPOSITION IN FORESTED HEADWATER STREAMS

David Stoker, Amber Falkner, Kelly Murray, Ashley Lang, Catherine Pringle, Jeffrey Hepinstall-Cymerman, Michael Conroy, Robert Cooper

T04: Aquatic Ecosystem

Resource subsidies are pervasive and can have implications for community dynamics and ecosystem processes in recipient systems. Forested headwater streams depend on leaf litter inputs, and elucidating the mechanisms and pathways driving the community- and ecosystem-level responses is of general ecological relevance. We conducted a reciprocal transplant experiment between two low- and two high-elevation streams within the Coweeta Hydrologic Laboratory, Otto, North Carolina, to address two objectives. Objective 1 evaluated the relative importance of (1) local adaptation of macroinvertebrates and (2) leaf litter composition to leaf decomposition. Objective 2 will implement structural equation modeling to evaluate how litter stoichiometry, shredders, predators, and water temperature interact to affect leaf decomposition. We observed an effect of litter composition on leaf decomposition ($P < 0.001$), while there was no discernible effect of local adaptation ($P = 0.409$). Our results suggest litter stoichiometry drives leaf decomposition in these forested headwater streams, and ongoing analyses are examining the pathways driving this important ecosystem function.

P-177: STREAM COMMUNITY COMPARISONS BETWEEN GLACIATED AND UNGLACIATED REGIONS OF OHIO

Wade Boys

T13: Population and Community Ecology

Geology and land use are among the most important factors influencing aquatic community structure and distribution of taxa in surface waters. In Ohio, there are regions that have been impacted by glaciers and areas without direct glaciation. The primary objective of this investigation was to examine differences in aquatic community structure in streams with different physiographic histories. In fall 2013, three streams from the Glaciated Till Plains (Hog Creek, South Fork of the Great Miami River & Macochee Creek) and three streams from the Unglaciated Allegheny Plateau (Kokosing River, Wolf Creek & White Eyes Creek) were sampled for epipelic and epilithic algae, macroalgae, macroinvertebrates, fish, and selected environmental parameters. Results show that epipelic algae and macroinvertebrates were more diverse in depositional habitats of the Till Plains (H', $p<0.001$), but riffle algal and macroinvertebrate community diversities were not significantly different between regions ($p=0.34$). However, both of these groups were negatively correlated ($r= -0.88$ and -0.90) with fish richness. Canonical correspondence analysis of diatoms, macroinvertebrate and fish functional feeding groups will be utilized to further elucidate the comparison between these taxonomic assemblages.

P-178: SPATIAL AND TEMPORAL ALGAL COMMUNITY VARIATION IN A DROUGHT-RESISTANT SPRING SYSTEM IN THE SANDIA MOUNTAINS, NEW MEXICO

Schelby Rosebrook, Robert Verb, Leslie Riley, Rebecca Bixby

T13: Population and Community Ecology

In xeric habitats, springs are geographically isolated systems which provide perennial water sources for aquatic organisms. Because drought events cause changing hydrologic conditions and water quality, they can potentially impact springs. This project sought to establish baseline information regarding temporal and spatial patterns of algal communities at a perennial spring/travertine waterfall/stream complex in the Sandia Mountains, New Mexico. Periphyton and macroalgae was sampled from seven sites; two in the spring above a waterfall, two within the waterfall, and three downstream from the waterfall. Collections were made during the pre-monsoon (June 2013) and post-monsoon (October 2013) season. Preliminary analyses indicate that diatoms dominated the spring section above the falls, while filamentous chlorophytes, xanthophytes, and cyanobacteria had greater abundances in the waterfall. Increased light levels and habitat heterogeneity likely led to increased filamentous algae along the waterfall face. Due to the importance of springs in arid-land ecosystems, these baseline data are critical as drought is predicted to become more severe and frequent in the southwestern USA.

P-179: MACROINVERTEBRATE BETA DIVERSITY AMONG STREAM MICRO-HABITATS

David Janetski, Carl Ruetz, Matthew Breen, Steven Kohler

T13: Population and Community Ecology

Examination of beta diversity and functional traits provides important information about biological function of ecosystems. To better understand diversity-function relationships at small scales in streams, we analyzed patterns of macroinvertebrate beta diversity and functional trait composition across micro-habitat (erosional, depositional, and woody debris) and season (winter, spring, and summer). In each season, we sampled each micro-habitat within nine stream reaches in Seven Mile Creek, Michigan. Results showed distinct communities by habitat, with limited variation across seasons. Depositional habitats had high proportions of copepods and ceratopogonid midges, erosional habitats were dominated by simuliids, and woody debris had high proportions of psychomyiid caddisflies. Analysis of beta diversity showed higher nestedness:turnover ratios among micro-habitats than among seasons, indicating that species tend to be lost (as opposed to replaced) from one micro-habitat to the next. Functional trait composition revealed variation across micro-habitats in biological function, particularly swimming ability, rheophily, and trophic habit, while little variation was detected across seasons. Our findings show that macroinvertebrate community structure and functional traits can differ at small spatial scales in streams.

P-180: SPATIAL AND TEMPORAL VARIATION IN MACROINVERTEBRATE COMMUNITY STRUCTURE IN THE PRESENCE OF AN INTRODUCED SNAIL

Stephanie Estell, Nicole Berry, Jonathan Stechschulte, Robert Verb, Leslie Riley

T13: Population and Community Ecology

Invasive species can reduce diversity in the introduced range, especially when invaders have strong negative interactions with native species and reach high abundance or biomass. The invasive New Zealand mud snail (Potamopyrgus antipodarum) was first documented in streams within the Greater Yellowstone Ecosystem in 1994 and became the dominant macroinvertebrate in many locations within a decade. Previous studies indicate that Potamopyrgus is also a superior competitor for periphyton resources when compared to native snails (Pyrgulopsis robusta) and caddisflies (Brachycentrus sp.). Despite the implication that Potamopyrgus could have negative impacts on macroinvertebrate diversity, little evidence exists to support this claim. The objective of this study was to document spatial and temporal variation in macroinvertebrate diversity within one catchment where densities of Potamopyrgus vary across sites and have also fluctuated over the past decade. Benthic macroinvertebrates were collected in riffle and depositional habitat at six sites in July 2014 following established protocols for previous macroinvertebrate collections at the same sites (2001 – 2007). Preliminary analyses indicate that macroinvertebrate diversity varies substantially across sites but is not related to changes in Potamopyrgus abundance.

P-181: FACTORS CONTROLLING MACROINVERTEBRATE ASSEMBLAGES IN TWO STREAMS WITH CONTRASTING MACROCONSUMER ABUNDANCES

Bethany Vazquez, Alonso Ramírez

T13: Population and Community Ecology

Abiotic and biotic factors are important drivers structuring stream benthic communities. In tropical island streams, abiotic factors (e.g., habitat, flow) interact with biotic factors (e.g., presence of predators) to create conditions that potentially affect macroinvertebrate assemblages. Our goal was to asses the composition of benthic macroinvertebrate assemblages in two tropical streams and assess whether habitat and shrimp abundance play a role in explaining patterns in composition and abundance. Study streams (Prieta and Bisley) were selected in the Luquillo Experimental Forest, Puerto Rico. Streams were similar in elevation and forest type, but contrasted in shrimp assemblages. Prieta had high shrimp densities and no predatory fish, while Bisley had predatory fish and few shrimp. Macroinvertebrate abundances in Prieta riffles were higher than pools, while Bisley pools showed higher abundance than riffles. Richness followed similar patterns as abundance. Multiple regression analyses indicated that shrimp abundance was the main factor explaining macroinvertebrate patterns. Overall, our study found that macroinvertebrate assemblages are strongly related to shrimp presence and abundance, but other factors might also play a role explaining assemblage structure.

P-182: INFLUENCE OF WOOD AND BARK PROPERTIES ON DIATOM AND MACROINVERTEBRATE COLONIZATION PATTERNS

Janet Deardorff, Michael Taylor, Chad Carroll, Dawn DeColibus, Darrin Rubino, Eric Schultz, Leslie Riley, Robert Verb

T13: Population and Community Ecology

Woody debris plays numerous roles in aquatic systems including retention of particulate matter and the provision of available habitat and stable for aquatic organisms. Thus, this study set out to determine the impact of different types of woody debris on algal and macroinvertebrate colonization patterns and the role macroinvertebrates had in shaping the epidendric diatom community. Nine different wood types were cut into 10-cm segments. Wood pieces were assigned to either a caged (macroinvertebrate exclusion) or uncaged treatment. Over the course of eight weeks, six segments of each wood type (three caged, three uncaged) were extracted on a weekly basis and processed for diatoms and macroinvertebrates. While preliminary analysis showed that the wood substrate made an excellent habitat there was, in most cases, a limited preference of taxa towards a particular wood type. Additional analyses will examine the relationship of various wood and bark properties (e.g., bark roughness, specific gravity, porosity) on measurements of community diversity and density.

P-183: PRELIMINARY ANALYSIS OF AQUATIC COMMUNITY STRUCTURE NEAR A LOWHEAD DAM

Rody Seballos, Wade Boys, Kelsey Weidner, Robert Verb, Leslie Riley

T13: Population and Community Ecology

The Jackson Street lowhead dam on the Ottawa River (Lima, Ohio) was originally installed to maintain water levels during dry periods of the year. This dam is candidate for removal to restore a more natural flow and one baffle has already been extracted from the northern portion of the dam. The objective of this investigation was to survey the aquatic life above and below the dam to create a baseline dataset of the community structure prior to dam removal. On August 29, 2014 two riffle habitats (five samples each) were sampled downstream of the dam and one riffle (five samples) was sampled upstream. At each site, selected physical and chemical parameters were measured along with collections of fish, periphyton, macroalgae and macroinvertebrates. Preliminary MANOVA analysis indicated that the site immediately downstream from the dam had the highest current velocity ($p<0.05$) and macroalgal community coverage (large bloom of Pamellopsis) ($p<0.001$). Future multivariate analyses will attempt to determine if there are differences in the other sampled aquatic communities and abiotic parameters above and below the dam.

P-184: BENTHIC COMMUNITIES OF TIP-UP POOLS FROM A SOUTHEASTERN INDIANA FLATWOODS

Paige Kleindl, Darrin Rubino, Leslie Riley, Robert Verb

T13: Population and Community Ecology

Forests of the Illinoian tillplain in southeastern Indiana are characterized by unique hydrology, soil features, and woody species composition. These hydro-mesophytic forests are typified by their poor drainage and lack of topography, topographic variation is limited to pit-and-mound topography resulting from tree falls. The tree fall pit represents a unique microhabitat in the forest matrix. Although much attention has been given to the woody species composition of these unique forests, almost nothing is known about the biota of these pits. In June 2010, nine tip-up pools from Tribbetts Woods, an old-growth remnant forest in Jennings County, Indiana, USA were visited to determine their diatom and macroinvertebrate community composition and their corresponding physiochemical conditions. Preliminary redundancy analysis depicted that the distribution of diatom and macroinvertebrate taxa along the first four (Monte Carlo permutation, $p<0.05$) multivariate axes were influenced by pool age, canopy cover and various geomorphological measurements of the pool (e.g., depth). It appears that these tip-up pool communities are dominated by acidobiontic diatoms (e.g., Eunotia) and chironomids. Additional analyses will be employed to examine spatial distributions between the benthic communities.

P-185: SURVEY OF BENTHIC ALGAL ASSEMBLAGES FROM GEOTHERMAL INFLUENCED AQUATIC SYSTEMS IN VALLES CALDERA NATIONAL PRESERVE

Robert Verb, David Miller, Leslie Riley, Rebecca Bixby, Relf Price

T13: Population and Community Ecology

Valles Caldera National Preserve (VCNP) of the Jemez Mountains, New Mexico (USA) has a rich volcanic history and contains an active geothermal system. In selected regions of the VCNP, the geothermal nature of local aquifers has a pronounced influenced on the environmental conditions of surface waters. Exploratory drilling within the VCNP has shown that Alamo and Sulfur Canyons are two locales that have surface waters influenced by sulfate enriched hot springs, sulfuric acid and hydrogen sulfide. The primary objective of this study was to survey the benthic algal assemblages along an elevational gradient (2,700 to 2,500-m) in these two locales. Four sites (3 Alamo Creek, 1 Sulfur Canyon) were sampled for basic water chemistry and various substrate types were surveyed for algal communities. There was a strong correlation (r=0.99) between surface water pH (4.1-2.3) and elevation, suggesting the influence of the geothermal inputs is enhanced with drops in the topography. The epipelic algal community was characteristic of low pH (Eunotia exigua, Euglena mutabilis) and decreases in measurements of community diversity were strongly correlated (r=0.89) with decreasing pH levels.

P-186: MODELING GENE FLOW ACROSS A FRAGMENTED RIVER NETWORK

Matthew Fuller, Martin Doyle

T13: Population and Community Ecology

Habitat fragmentation in rivers is ubiquitous. Both natural and anthropogenic agents fragment rivers longitudinally and these barriers affect organisms locally through habitat alteration/loss and regionally by reducing connectivity among populations. We evaluated the influence of river network fragmentation within the Neuse River Basin in North Carolina on a freshwater mussel species using the gene flow model CDPOP. The model allows varying the resistance to dispersal between river segments by altering dam permeability based on their structure characteristics (e.g., height, spillover type, etc.). Additionally, by testing the sensitivity of varying the carrying capacity of river segments based on their location within the river network (e.g., carrying capacity adjacent to dams might be reduced as an indicator of habitat loss or degradation), the influence of habitat fragmentation, loss, and degradation can be evaluated independently. Our modelling exercise helps identify barriers and sections of river networks that are more or less important for connectivity in the river network for a freshwater mussel metapopulation and attempts to identify the distinct impacts of habitat fragmentation, loss and degradation.

P-187:

Craig D. Snyder, James R. Webb

T12: Bioassessment

Total mercury concentrations in the environment have not been found to be effective predictors of bioaccumulation in fish. Rather, physical, chemical, and biological conditions at a site have been found to be more important, presumably due to site influences such as water chemistry on mercury methylation rates. However, there remains considerable uncertainty regarding mercury accumulation mechanisms in fish, especially in lotic habitats where substantially less research has been conducted. We examined whole-body total mercury concentrations in brook trout collected from 28 sites in 14 watersheds in Shenandoah National Park, Virginia. We found substantial variation in fish mercury concentrations (8.9 to 159.3 ng g-1). Although total body weight explained 26% of the variation in mercury concentrations overall, the relationship was highly variable among sites with body weight strongly correlated with mercury at some sites and only weakly correlated at others. Moreover, we observed a previously unreported relationship wherein the rate at which mercury accumulates with body size (i.e., regression slope) was inversely related to the amount of mercury in young fish (i.e., y-intercept). Possible mechanisms for this relationship are discussed.

P-188: VARIABILITY IN MACROINVERTEBRATE ASSEMBLAGES AMONG TALLGRASS AND MIXED GRASS PRAIRIE HEADWATER STREAMS

Logan Shoup, Matt Whiles

T13: Population and Community Ecology

Grasslands of the central Great Plains have been heavily impacted by agriculture and urbanization. There have been widespread research and restoration efforts on the region's terrestrial ecosystems, but the streams that drain them have received much less attention. Most research on prairie streams has taken place at the Konza Prairie Biological Station (KPBS) in the tallgrass prairie ecoregion, but the degree to which KPBS streams reflect conditions of prairie streams in general is unknown. We sampled macroinvertebrate communities in 5 headwater streams located in Kansas and Oklahoma (n=3 in tallgrass, n=2 in mixed grass), and found differences in macroinvertebrate community structure between mixed and tallgrass prairies streams (ANOSIM, p=0.049). Differences were primarily driven by greater abundance of Physidae (14% contribution to dissimilarity), Baetidae (14%), Hyalellidae (12%), Coenagrionidae (7%), and Ostracoda (5%) in mixed grass streams. We hypothesize that these differences are due to differences in hydrology among sites and less canopy cover along the mixed grass streams. Broadening our understanding of prairie stream structure and function will help guide management and restoration of these imperiled systems.

P-189: ALTERNATIVE DYNAMIC REGIME THEORY:LARGE SCALE COMMUNITY SHIFTS IN A NEWLY RESTORED LAKE ACROSS MULTIPLE COMMUNITY LEVELS

Logan Benedict, Michael Lemke

T13: Population and Community Ecology

Alternative dynamic regime theory of shallow lakes is characterized by shifts between turbid algae-dominated and clear aquatic vegetation-dominated states. Shallow lakes undergoing ecological restoration have yet to be explored in this theory. Even less exploration has gone to understanding multiple community-level shifts. This research investigates the first five years of multiple aquatic community data from Thompson Lake at The Nature Conservancy's Emiquon Preserve, Lewistown, IL; a lake undergoing restoration. In 2008, Thompson Lake's clear water was low in nitrogen and high in SRP leading to an extensive cyanobacteria (Aphanizomenon flos-aque) bloom and shifting to turbid water in 2010-2012. This decrease Secchi depth corresponds to shifts in phytoplankton, zooplankton, aquatic vegetation, and fish compositions, with gizzard shad showing 145% population growth. A comparison of these communities with five years of reference data from the same period in a non-restored lake (Lake Wingra, WI) provides support for regime shifts in Thompson Lake. Three stages of community structuring have been categorized: early restoration, transition stage, and late restoration. This research uses a more inclusive multiple community approach to describing shallow lakes undergoing restoration.

P-190: NEW RECORDS AND RANGE EXTENSIONS OF MACROINVERTEBRATES FROM LAKE SUPERIOR

Gerald Shepard, Adam Frankiewicz, Brent Gilbertson, Kurt Schmude

T13: Population and Community Ecology

During 2012 & 2013, macroinvertebrate surveys targeting invasive/rare species were conducted by the US EPA in Lake Superior around Isle Royale National Park (MI), within the St. Louis River Estuary (MN & WI), and Chequamegon Bay (WI). Twelve new taxa records/possible range expansions are documented from these study sites, including Oreodytes laevis (Coleoptera: Dytiscidae), Anafroptilum (possibly ozarkensum) (Ephemeroptera: Baetidae) (ID provided by Dr. Tom Klubertanz, UW-Rock County), Allocladius (near bothnicus) (Diptera: Chironomidae), Constempellina (Diptera: Chironomidae), & Gyrinus cavatus (Coleoptera: Gyrinidae) from Isle Royale. We identified Polypedilum epleri (Diptera: Chironomidae), Sparbarus lacustris (Ephemeroptera: Caenidae), and the European Faucet Snail Bithynia tentaculata (Gastropoda: Bithynidae) from the St. Louis River Estuary. Oecetis nocturna (Trichoptera: Leptoceridae) was identified from all study locations. Caenis hilaris (Ephemeroptera: Caenidae) was found in the St. Louis River Estuary and Chequamegon Bay. Lastly, we identified Sparbarus maculatus, Sparbarus lacustris (Ephemeroptera: Caenidae), and Palmacorixa janeae (Hemiptera: Corixidae) from Chequamegon Bay. This research was funded wholly by the U.S. Environmental Protection Agency through contracts EP-D-08-089 & EP-D-13-052 to EMR Inc. and Badger Technical Services.

P-191: POTENTIAL FOR CONTRASTING NUTRIENT SUBSIDIES TO GREAT LAKES TRIBUTARIES BY NATIVE AND NON-NATIVE MIGRATORY FISHES

Ashley Moerke, Matthew Elya, Brandon Gerig, Dominic Chaloner, Michael Brueseke, Gary Lamberti

T14: Ecology of Fish and Other Aquatic Vertebrates

Resource subsidies have been shown to be ecologically important to aquatic ecosystems. However, little evaluation has been conducted of the subsidies associated with abundant fish migrations that occur between the Great Lakes and their tributaries. We compared the dynamics of dissolved nutrients excreted and dissolved carbon secreted by live non-native Chinook Salmon (Oncorhynchus tshawytscha) and Atlantic Salmon (Salmo salar), and native White Sucker (Catostomus commersonii) spawners. During spawning runs, five adults of each species were placed into separate containers of stream water, and then filtered water samples were collected hourly over 8 hours. Samples were analyzed for dissolved phosphorus (SRP), nitrogen (NH_4^+), and carbon (DOC), and then standardized by wet mass. Mean hourly NH_4^+ excretion rates were similar for all species, whereas SRP excretion rates were 2-4x higher for Atlantic Salmon and DOC secretion rates were 3-10x higher for Chinook Salmon. Thus, historical and ongoing changes in Great Lakes migratory fish run size and composition may alter nutrient loading to tributaries with broader implications for stream productivity and food web dynamics.

P-192: DISSIMILARITIES BETWEEN BROOK AND BROWN TROUT SEASONAL HABITAT USE AND MOVEMENT PATTERNS: IMPLICATIONS FOR HABITAT IMPROVEMENT

Justin Wegner, Nathaniel Akey, Mark Luttenton, Graeme Zaparzynski

T14: Ecology of Fish and Other Aquatic Vertebrates

Understanding differences in seasonal habitat use and movement patterns between trout species is important for effective concurrent management. Using radio telemetry, we tracked 17 brook trout in the Mainstream and North branch of the Au Sable River, MI from June 30 through October 25, 2014 to determine habitat use, and daily movement. Brook trout did not exhibit nighttime movement patterns common for brown trout in the same system and occupied habitats that were generally near shore, relatively shallow, smaller in size, structurally less complex, and offered less overhead cover than typical brown trout habitats. It is unclear why brook trout occupied these habitats, but competition with brown trout or the availability of cold-water refugia during summer months may partially explain these results. Because brook and brown trout behavior and habitat use appear to differ, both species should be accounted for when planning habitat improvement and protection projects. Further research should focus on the significance of thermal refugia and interspecific competition on brook trout habitat use.

P-193: SPATIAL PATTERNS OF FISH ASSEMBLAGES IN LAKE MICHIGAN DROWNED RIVER MOUTHS

Samantha Morsches, David Janetski, Carl Ruetz

T14: Ecology of Fish and Other Aquatic Vertebrates

Spatial patterns of species similarity in freshwater fish assemblages can be affected by dispersal processes and environmental conditions. We sampled littoral fish assemblages in 15 drowned river mouths (DRMs) of eastern Lake Michigan using 10-min electrofishing transects (n=5-6 per DRM). Transect environmental conditions were also measured. We captured 3,080 fish representing 45 species across the 15 DRMs. Using nonmetric multidimensional scaling, we found evidence of spatial structure in fish assemblages with the southern DRMs distinct from the others. Using canonical correspondence analysis, we found evidence that the southern DRMs were associated with high specific conductivity and turbidity. However, we did not find evidence of a positive correlation between species similarity and distance between each pair of DRMs, contrasting with a previous study in a subset of these DRMs and our original hypothesis that species similarity decreases with distance. A potential explanation for this finding was related to gear selectivity associated with boat electrofishing. We suggest that sampling fish with additional gear or approaches may be necessary to more rigorously test for the spatial pattern in littoral fish assemblages.

P-194: ARE SALMON JUST BAGS OF ALLOCHTHONOUS NUTRIENTS?: ASSESSING FISH GROWTH ACROSS FOUR NUTRIENT-TREATED STREAMS IN CENTRAL IDAHO

Martin Ventura, Lytle Denny, Colden Baxter, David Richardson, Sam Matsaw Jr.

T14: Ecology of Fish and Other Aquatic Vertebrates

Decreased allochthonous subsidies and losses of benthic bioturbation have accompanied declines in Pacific salmon returns to historic spawning streams in the Western U.S. To simulate these annual nutrient pulses, fisheries managers have developed remediation protocols in which Salmon Carcass Analog (SCA) or adult salmon carcasses are added to streams. However, neither SCA nor carcasses can re-create the benthic disturbance of spawning salmon. Within a modified BACI framework, we conducted mark-recapture surveys to measure changes in fish biomass in four tributaries of the Yankee Fork of the Salmon River, Idaho. These were treated with 3 different forms of salmon subsidy: SCA, salmon carcasses, live spawning Chinook, and a control. In two July 2014 sampling efforts, we weighed, measured, and PIT-tagged resident Chinook salmon (Oncoryhnchus tshawytscha), bull trout (Salvelinus confluentus), steelhead (Oncorhynchus mykiss), and sculpin (Cottus spp). In October, all recaptured fish were identified and re-weighed. Understanding differences in fish production between our study streams is an initial step toward creating a more sensitive model for estimating effects of common nutrient remediation treatments, including additions of live fish.

P-195: THE INTENSITY AND SEVERITY OF ENCYSTMENT PATTERNS OF BLACK SPOT DISEASE IN MINNOW HOST RHINICHTHYS ATRATULUS IN SENECA WATERSHED TRIBUTARIES

Shannon Beston, Collin Funkhouser, Matthew Walsh, Susan Cushman

T14: Ecology of Fish and Other Aquatic Vertebrates

For most parasitic organisms, attachment to a host is the difference between life and death. Because the host acts as the primary source of nourishment and shelter, parasites have evolved multiple ways to successfully attach themselves to their host. Black spot disease is common in freshwater fish and results in small black cysts that house the parasite in the skin of its host. We monitored the prevalence of black spot disease in blacknose dace Rhinichthys atratulus during 2012-13 in five tributaries in the Seneca Lake watershed (Geneva, NY). A 75-meter reach was electrofished at each stream site and length and weight were recorded for all infected fish. Photographs were taken of the left side of the fish. Using ImageJ, the surface area, cyst size, and percent surface area covered by cysts were measured to determine if the frequency and intensity of infection varies across streams and size classes of fish. Our results will highlight the use of a technology-based technique to answer an ecological question while offering possible rational for the non-random pattern of infection observed.

P-196: ROUND GOBY (NEOGOBIUS MELANOSTOMUS) CATCH TRENDS ACROSS THE NEARSHORE HABITATS OF NORTHERN LAKE MICHIGAN

Taaja Tucker, Steven Farha, Erica Johnson, Paige Wigren, Stephen Riley

T14: Ecology of Fish and Other Aquatic Vertebrates

Native Cladophora algae cover has increased dramatically in northern Lake Michigan, producing both extensive live-growth beds and depositional sites where sloughed Cladophora has decayed, coincident to the invasion of the round goby (Neogobius melanostomous). To understand the role of these habitats in the distribution of the goby, catch trends across time, space, and different habitat types were analyzed using minnow traps and gill net data from near Sleeping Bear Dunes National Lakeshore from 2010-2014. Boosted regression tree models of catch per unit effort (CPUE), average length, and the proportion of male gobies were produced from habitat and potential prey metrics. CPUE increased when water temperatures were higher, in the early summer, in areas with high Cladophora algae coverage and moderate amounts of quagga mussel coverage, and in areas with increased benthic prey diversity. Larger gobies were often found in the early summer and in areas with high mussel coverage; small gobies were more common at shallow (<15 m) depths. Numbers of males increased at shallower sites with bare sediment. Overall, round goby distribution was best explained by seasonality.

P-197: THE EFFECT OF HABITAT ALTERATION ON DRAGONFLY POPULATIONS IN A SOUTHWEST FLORIDA SWAMP SLOUGH SYSTEM.

Cheryl Black

T15: Disturbance

The abundance of three predominant dragonfly species; Libellula incesta, Pachydiplax longipennis, and Erythemis simplicicollis, was surveyed from April 2010 to December 2014 at Six Mile Cypress Slough Preserve in Lee County, Florida. Several observations were made monthly at three similar pond habitats before (2010-2011) and after (2013-2014) the removal of emergent shoreline vegetation by the County. Populations of P. longipennis and especially L. incesta exhibited significant declines in all ponds due to loss of preferred perch sites. Erythemis simplicicollis populations increased significantly at all sites. Removal of vegetation resulted in an increase in mats of surface algae for perching by this species. This ongoing study contributes to the establishment of baseline data on odonate populations in the Slough and will be a valuable asset to determine how habitat alteration impacts the Preserve.

P-198: DISENTANGLING DISPERSAL LIMITATION AND ENVIRONMENTAL FILTERING EFFECTS ON TRAIT DISTRIBUTIONS IN HEADWATER STREAMS

Erin Larson, LeRoy Poff, Andrea Encalada, Alexander Flecker

T15: Disturbance

Understanding the relative importance of dispersal limitation and environmental filtering on community assembly has implications for our understanding and management of freshwater systems, especially because dispersal limitation is rarely controlled for in studies of environmental filtering. We propose a study utilizing observational and experimental approaches to disentangle the effects of dispersal limitation and disturbance regime in structuring community trait distributions. Our study will occur across a gradient of disturbance regimes in multiple headwater streams in the Napo drainage in Ecuador. First, we plan to determine if species traits correlate best with spatial proximity or physical data at multiple scales (e.g. reach bed mobility, watershed size), to separate dispersal limitation and environmental filtering on trait composition. Utilizing these observational measurements, we propose a mesocosm experiment manipulating disturbance intensity to determine how community trait distributions change under differing disturbance regimes. By holding dispersal limitation constant in these experiments, the effect of environmental filtering in this system can be isolated from that of dispersal limitation.

P-199: CONSERVING AQUATIC ECOSYSTEM SERVICES THROUGH THE EMULATION OF NATURAL DISTURBANCES PARADIGM FOR SUSTAINABLE FOREST MANAGEMENT

Jordan Musetta-Lambert, Elisa Muto, Dave Kreutzweiser, Paul Sibley

T15: Disturbance

Applying the emerging paradigm of emulation of natural disturbances (END) to forest management requires understanding how the riparian-aquatic interface responds to forest disturbances. A comparison of riparian forest condition and stream characteristics was conducted by assessing vegetation communities, litter inputs to streams, in-stream litter decomposition, and associated aquatic invertebrate communities in low-order boreal streams in catchments with disturbance histories including forest fire, logging with riparian buffers, and undisturbed. Shrub and juvenile woody-stem densities and richness were higher at fire than logged and reference sites. Mature tree densities at reference sites were 2x and 30x higher than at logged and fire sites, respectively. Litter decomposition rates were slightly higher at fire and lower at logged than reference sites. Invertebrate communities were distinctly characterized by unique shredder taxa, and leaf litter input composition was greater and communities dissimilar at fire than at logged and reference sites. Detectable differences in riparian forest condition and in-stream processes suggest that riparian management to emulate fire disturbance under END could promote ecosystem services by inducing forest succession and enhancing biodiversity, organic matter processing and habitat complexity.

P-200: FISH COMMUNITY RESPONSE TO AN EXTREME FLOOD EVENT IN AN URBAN STREAM: SAND CREEK, DENVER, COLORADO

Mindy Sprague, Grant DeJong, Craig Wolf, Jamie Nogle, Lee Bergstedt, Steve Canton

T15: Disturbance

Extreme flood events in urban landscapes are expected to be particularly catastrophic to aquatic communities, especially fish, because channelization and reinforced bank habitat constrain the floodplain where fish often seek refuge from high flows. Severe flooding (>100-year recurrence interval) occurred between September 13 and 20, 2013, in the Denver metropolitan area. Fish sampling and habitat evaluation on six reaches of Sand Creek was conducted in July and November 2013. Substantial changes to instream habitat were not observed in the study reaches. Individual fish collected after the floods were likely not long-term residents at the sites, but total fish density was greater than in July and well within the range of densities observed in this reach since 1996. Fish community composition has remained fairly stable since 1996, but greater species richness was found after the floods in 2013 compared to the July sampling event. Relocation of fish by high flows, as well as isolation of populations by instream drop structures after flows returned to typical low-flow conditions, may have resulted in little net change to the fish community.

P-201: RESPONSE OF EMERGENT INSECT COMMUNITIES TO LANDSCAPE AND HYDROLOGIC CHANGES ASSOCIATED WITH URBAN DEVELOPMENT IN WETLANDS OF WEST CENTRAL FLORIDA

Nathaniel Goddard

T16: Urban Ecology

Urbanization geographically alters landscapes reducing habitat heterogeneity and altering hydrology and water chemistry of local wetlands. We surveyed emergent insect communities of 25 wetlands in Tampa of Florida to determine what effects, if any, landscape and hydrological alteration had on insect community structure. During the study emergence peaked in July following initial inundation, then steadily declined until the wetlands dried out. The community structure was dominated by the order Diptera accounting for 89% of insects surveyed, and among these the family Chironomidae accounted for 59%. As standing water persisted community succession progressed with the appearance of and steady increase of predatory insects of the orders Hemiptera and Coleoptera, possibly contributing to the overall decline in emergent rates. We used an AIC model selection approach with stepwise linear regression models to determine the importance of physical and geographic parameters on emergent insect communities. We found that insects responded differently Diptera prospering in urban areas while all other populations declined. Our final model included two factors, forest area and hydroperiod as having the greatest influence on emergence (R-squared = 0.35, p=0.013).

P-202: DOC AND CPOM ALTER INVERTEBRATE COMMUNITY COMPOSITION AND FOOD WEB DYNAMICS IN AN URBAN STREAM

Molly Christie, Courtney Marlinski, Ryan Koch, David Kerling, Jonathan O'Brien

T16: Urban Ecology

We examined the effects of differing allochthonous organic matter sources on food web characteristics of an urban stream. We deployed 24 rock baskets containing leaves and DOC diffusing substrata (2x2 factorial design) in Ransom Creek for three weeks. Rock baskets were then retrieved and processed in the lab. We used fatty acid methyl ester (FAME) analysis to establish food web linkages. There was a strong enrichment effect due to the leaf treatment, resulting in a 60% increase in the total number of invertebrates, with significant increases in the densities of Chironomids, Gammarus (amphipoda), and Caecidotea (isopoda). Hydropsyche larvae showed a strong response due to the DOC treatment, resulting in a tripling of density and a dramatic boost in the %EPT of the community. We attribute the increase in Hydropsyche to greater food resources available to filter feeders through the microbial loop. We found that leaf inputs from the surrounding riparian zones are likely to boost densities of dominant taxa in the stream, but alternate food resources such as DOC may have a more substantial impact in altering food web characteristics.

P-203: ACCOUNTING FOR BIOTIC VARIABILITY IN URBAN STREAMS: THE ROLE OF LOCAL AND LANDSCAPE FACTORS

Catherine Bentsen, Allison Roy, David Armstrong

T16: Urban Ecology

As impervious coverage increases, fish and macroinvertebrate assemblages consistently degrade. At low impervious levels, however, biotic integrity still varies widely across streams, suggesting a range in resistance to urban disturbance. Thirty-two sites were selected across Massachusetts within two narrow bands of impervious cover: 1.0–4.0% (n = 16) and 7.0–10.0% (n = 16). At these sites, fish richness ranged from 3–11 species (lower band) and 2–8 species (higher band). Macroinvertebrate richness varied from 18–33 species (lower band) and 8–29 species (higher band). Physicochemical and habitat variables were sampled at each site to determine whether they explain the biotic variation. Preliminary analysis indicates a wide array of environmental conditions: substrate D50 ranged from 1–180 mm and average embeddedness ranged from 0–54%. Across sites, summer water quality varied from 3.82–9.28 mg/L dissolved oxygen, 6.3–7.6 pH, 63.3–505.3 µS/cm conductivity, and 0.43–12.82 mg/L nitrate. An understanding of physicochemical and habitat characteristics, in addition to landscape development patterns, that confer resistance to urbanization will help guide management initiatives that protect ecosystem integrity.

P-204: SHIFTS IN NUTRIENT LIMITATION AND NUTRIENT UPTAKE ALONG AN URBAN WATERSHED GRADIENT

Elizabeth Ogata, Michelle Baker

T16: Urban Ecology

In Utah and other western states, stream biofilms are commonly limited by nitrogen or colimited by both nitrogen and phosphorus. Interestingly, when added alone, phosphorus may slightly reduce chlorophyll levels in these biofilms. Although the mechanism remains unclear, it is thought that bacteria may outcompete algae for phosphorus and, consequently, lower chlorophyll levels. Our study explored how the relative balance of autotrophs and heterotrophs in stream biofilms may influence nutrient limitation and uptake in three urbanizing Utah watersheds. To assess which nutrient(s) limited primary production, we measured biofilm response (Chl a) to additions of either: nitrogen (NH4-N), phosphorus (PO4-P), both nitrogen and phosphorus, or no nutrients, in nutrient-diffusing substrates. We then compared the relative response of autotrophs and heterotrophs to nutrient enrichment with the Autotrophic Index (Ash-free dry mass / Chl a). In addition, we measured nutrient uptake rates of biofilms incubated in stream water enriched with either NH4-N or NH4-N + PO4-P at a series of concentrations. We will compare how biofilm community shifts between reference and urban sites may influence nutrient limitation and nutrient uptake.

P-205: SMALL THINGS IN SMALL STREAMS IN SMALL TOWNS CAUSING BIG PROBLEMS

Hannah Bachrach, Anna Gubbins, Margaret Pfeffer, Jordan Stark, Sarah Turner, Cathy Gibson

T16: Urban Ecology

Pharmaceuticals and plastics are widespread in aquatic environments, but the effects of these common, low-level contaminants are understudied. We used diffusing substrates to explore the effects and interactions of a heavy metal and an antibiotic on microbial biofilms in three sites: a forested stream, a storm-water dominated urban stream, and a stream with legacy industrial heavy metals and current wastewater treatment plant discharge. In addition, we assessed presence of microplastics upstream and downstream of small wastewater treatment plants and in storm-water dominated urban streams. Heavy metals from old industrial activities and aging infrastructure are common in many small towns in upstate New York. Metals have the potential to create interactive effects with antibiotics, and aging infrastructure can contribute these types of contaminants. Microbial biofilm respiration rate was significantly lower in the presence of a heavy metal, an antibiotic, and metal plus antibiotic in the forest stream but not in the two urban streams. Microplastics were present in all samples and were highest in the storm-water dominated stream during stormflow.

P-206: SPATIAL VARIATIONS IN ACTIVITY AND COMPOSITION OF THE CHICAGO RIVER SYSTEM MICROBIOME

Margaret Sladek, Timothy Hoellein, Rachel Poretsky, John Kelly

T16: Urban Ecology

Freshwater ecosystems in urban habitats are vulnerable to human activity. Microbial communities are essential to nutrient cycling within these habitats, so there is interest in understanding how anthropogenic stressors may impact them. We conducted our study in the Chicago River system, which receives multiple sources of anthropogenic inputs including effluent from a large wastewater treatment plant. The goal of this project was to characterize the activity, abundance, and taxonomic composition of benthic bacterial communities in the Chicago River system, and to determine how these parameters varied across locations within the system. Specifically, we measured nutrient chemistry, bacterial community activity (respiration and denitrification), bacterial abundance (direct counts), and bacterial community composition (next-generation sequencing of 16S rRNA genes) at nine sites within the North Shore Channel, North Branch and Main Stem of the Chicago River. We found significant variations in nutrient chemistry and bacterial community activity, abundance and composition, and observed a significant effect of the wastewater treatment plant effluent. The results of this study provide valuable insight into the influence of anthropogenic stressors on the microbiome of an urban river.

P-207: NOT ALL PAVEMENTS LEAD TO A STREAM: EFFECTS OF VARIATION IN IMPERVIOUS SURFACE CONNECTIVITY ON URBAN STREAM ECOSYSTEMS

Ethan Baruch

T16: Urban Ecology

Watershed urbanization leads to chemical and thermal pollution of urban streams and significant declines in aquatic biodiversity. However, most studies have focused on variation in total impervious surface cover (ISC) as the primary variable driving urban stream degradation. We asked instead whether the connectivity of ISC within watersheds alters its impact. We compared seven NC streams draining watersheds with similar development intensity (ISC 7-14%) but highly variable subsurface connectivity (pipe density 1.1-6.9 km/ha). Across these streams we measured remarkable variability in flooding frequency (8-16 events in the 17 week study period), maximum specific conductance (143-322 ?S/cm), and macroinvertebrate taxa richness (11-21). Contrary to our predictions, pipe density was not a predictor of food chain length ($p=0.34$) or heavy metal bioaccumulation ($p>0.05$) across these streams. We did find, however, that tissue concentrations of both copper and lead in several taxa (Cambaridae, Tipulidae, and Hydropsychidae) were correlated strongly with pipe density ($p<0.05$), but not ISC. Our results suggest that the connectivity of ISC may drive considerable variation in the magnitude of ecosystem degradation associated with the same level of development.

P-208: BIOTURBATOR IMPACTS ON NUTRIENT CYCLING AND MICROBIAL PROCESSES IN RESTORED WETLAND SOILS

Abby Hoffman

T17: Lakes and Wetlands

In the Midwest, agricultural land is often flooded for wetland restoration, however these wetlands sometimes store less carbon, remove less nitrogen and release phosphorous. This study aimed to test whether bioturbators enhance wetland functioning. We hypothesized that bioturbator activity would 1) increase Fe-bound phosphorus through sediment aeration, 2) increase denitrification in anoxic castes, and 3) increase microbial activity by creating microsites with varying redox conditions. To test this, we created microcosms with soil from three restored agricultural wetlands, adding zero, low, medium or high densities of worms (Lumbriculus variegatus). We analyzed for dissolved forms of phosphorus and nitrogen in pore waters and monitored microbial activity by measuring respiration and denitrification potential. Bioturbators had variable impacts on phosphorus, depending on soil type and worm density. Bioturbators also increased or did not impact pore water nitrogen. In addition, bioturbators increased respiration and denitrification, indicating larger microbial communities. Overall bioturbators had variable impacts on wetland functioning.

P-209: MONITORING BLUE-GREEN ALGAE DYNAMICS AND WATER QUALITY IN TWO EUTROPHIC WATER SYSTEMS

Nemesis Ortiz-Declet, Bradley Roy, Peter Isles, Jason Stockwell

T17: Lakes and Wetlands

Climate change is expected to influence aquatic ecosystems, creating the necessity to collect data related to the effects of weather on water dynamics and food webs. In this comparative study, we test for relationships between weekly water quality measurements and weather data in two aquatic systems, located 70 km apart, in Vermont. The first, Shelburne Pond, is a small, shallow hyper-eutrophic system, and the second, Missisquoi Bay in Lake Champlain, is a large, shallow eutrophic system. Missisquoi Bay has six major river tributaries and Shelburne Pond has none. Both systems experience cyanobacteria blooms during the summer. Because the study sites differ in surrounding land use, and susceptibility to wind-mixing events, we expected a difference in time of development and the concentrations and intensity of cyanobacteria bloom patterns along with other studied water quality parameters. Results show that Shelburne Pond had a much longer and more intense cyanobacteria bloom period than Missisquoi Bay. The findings provide insight into aquatic systems' response to climate forcing and information to develop best water resource management practices to adapt to climate change in Vermont.

P-210: PHYSICAL-CHEMICAL ANALYSIS AND CHARACTERIZATION OF HARDY POND, MASSACHUSETTS: A CITIZEN SCIENCE AND INTERNSHIP PROJECT

Amelia Atwood

T17: Lakes and Wetlands

Hardy Pond, a freshwater pond located in suburban Waltham, Massachusetts, has undergone changes in depth and clarity and fish kills have occurred. Fertilization, storm runoff, and other anthropogenic effects are theorized to be leading to these anoxic conditions and reduction of depth. From October 2013 through September 2014, we collected water column physical-chemical data (e.g. temperature, dissolved oxygen, salinity, pH, and conductivity), Secchi depth, and a surface water grab sample in the middle of the pond. Water samples were process for total suspended solids, non-volatile suspended solids, chlorophyll, particulate CNP, total dissolved N and P, and dissolved inorganic N and P. We plotted depth profiles by month for each parameter, and characterized the pond using summer chlorophyll a concentrations, Secchi disk data, and total phosphorous. Hardy Pond was largely hypertrophic in the summer months (June – September 2014) based on the use of a trophic classification system with the bottom half of the pond going hypoxic/anoxic during later summer months. This information is reported to the HPLA board on an annual basis so they can make management decisions.

P-211: BENTHIC INVERTEBRATE DEPTH DISTRIBUTION IN LAKE WITH A DEEP METALIMNETIC PHOTOSYNTHETIC COMMUNITY (DCM)

Brendan Martin, Jerry deNoyelles, Rachel Bowes, James Thorp

T17: Lakes and Wetlands

The distribution of benthic invertebrates is affected by physical, chemical, and biological processes. These processes interact to create distinct niches, however little research has been conducted on benthic-pelagic interactions. We investigated benthic invertebrate depth distribution in a protected Kansas reservoir with a deep metalimnetic photosynthetic community (DCM). The reservoir has a protected watershed managed by the University of Kansas, making it an ideal model for a minimally disturbed, stratified lake. Benthic samples were collected at meter depth increments and invertebrates were identified and counted. The distribution, abundance, and richness of benthic invertebrates were analyzed in conjunction with a long-term DCM data set and water quality depth profile. By studying benthic invertebrates in the presence of DCM, we can observe how this system-specific occurrence affects benthic invertebrate functional groups and benthic-pelagic interactions, proposing a level of system complexity not recognized in standard lentic ecosystem models or water quality assessments.

P-212: MACROPHYTE ASSOCIATED MICROBIAL NITROGEN AND PHOSPHOROUS CYCLING IN AN URBAN WETLAND

Aaron Marti, Melody Bernot, Allison Rober

T17: Lakes and Wetlands

Wetlands in urban-dominated watersheds can serve an important role in nutrient cycling and removal. These ecosystem processes are often mediated by plant-microbial interactions. We measured microbial N and P cycling and physicochemical characteristics associated with wetland plants (individual species, functional groups), floating algal mats, and non-vegetated sediments (control) in a central Indiana urban wetland. Physicochemical characteristics of water and sediment were measured in situ. Sediment microbial activity (as nutrient uptake and respiration) was measured in vitro. Sediments of deep-rooted species had higher organic matter content than sediments associated with shallow-rooted species. Additionally, microbial activity rates were higher in sediments of deep-rooted species. Across plant types, sediment microbial activity was positively correlated with organic matter content. Nutrient uptake rates were also correlated with respiration rates. Our results demonstrate variability in plant-associated microbial nutrient cycling in wetlands. Our findings provide insight into the influence of plant diversity on microbial nutrient cycling which may be important to consider for wetland restoration, mitigation and management in urban landscapes.

P-213: CHANGES IN INVERTEBRATE COMMUNITIES OF TWO NORTHERN MINNESOTA SEASONAL PONDS RELATED TO CLIMATE VARIABILITY

Sheila Northbird, Pete Maas, Sue Eggert, Annette Drewes, Dave Ongaro, Matt Frazer, Michelle Marion, Kristina Isham

T17: Lakes and Wetlands

Changes in climate (e.g. ice-out dates, storm intensity) and land use may affect taxa composition and biomass in forested seasonal ponds. We compared taxa richness and functional feeding group (FFG) biomass for pond 21 impacted by blowdown (2013) and timber salvage (2014) and pond 288c impacted only by blowdown. Both ponds experienced interannual differences in ice out dates. We found no significant differences in mean daily water temperature between 2013 and 2014, but a later ice out date in 2014 caused degree days (ice out date to invertebrate sampling date) to be nearly 3x greater than in 2013. In pond 288c we observed a 49% increase in total biomass in shallow habitats (predators and shredders) from 2013 to 2014. FFG composition changed in deep habitats of pond 288c between years (gatherers decreased, filterers increased). In pond 21 total biomass declined by 50% in deep habitats (predators decreased, scrapers increased). In 2014 we collected additional taxa not found in both ponds the previous year. It appeared that climate impacts, particularly ice out dates, may affect invertebrate communities more than other disturbances.

P-214: INTERANNUAL VARIATION IN INVERTEBRATE COMMUNITIES IN NORTHERN MINNESOTA SEASONAL PONDS

Sue Eggert, Annette Drewes, Sheila Northbird, Pete Maas, Dave Ongaro, Matt Frazer, Michelle Marion, Kristina Isham

T17: Lakes and Wetlands

Invertebrate community structure in the same seasonal forested pond can vary greatly from year to year. It has been hypothesized that variation in invertebrate responses results from variability in initial conditions in ponds. In 2013 we began monitoring invertebrate assemblages and physical variables in shallow and deep habitats of six ponds in northern MN on the same day (May 14) each year to observe how invertebrate populations respond to variation in initial physical conditions. While mean daily water temperatures did not vary greatly between years, accumulated degree days were 3X greater in 2014 due to earlier ice out. Five additional taxa were collected during 2014 than during the previous year suggesting that some taxa were further along in their life cycles. The increase in degree days did not result in significant increases in abundance and biomass; total biomass, gatherer biomass (fairy shrimp), and filterer abundance (mosquito larvae, fingernail clams) were significantly lower in 2014 than 2013. Examining additional sources of abiotic and biotic variation and continuing long-term data collection will help explain patterns of invertebrate communities in northern seasonal ponds.

P-215: DISTANCE-BASED MEASURES TO DETERMINE WETLAND ADJACENCY: REGIONAL AND NATIONAL IMPLICATIONS

Charles Lane, Ellen D'Amico

T17: Lakes and Wetlands

To better understand the implications of distance-based measures of potentially connectivity, we combined National Wetlands Inventory data with the National Hydrography Dataset and quantified the abundance of potentially non-adjacent wetlands of the United States. We further compared our results across multiple distance measures, 10-m, 30-m, and 300-m, in five areas of the country with known high densities of non-adjacent or so-called “geographically isolated wetlands.” At the national scale, we identified over 9.6 million unique wetland polygons that were potentially non-adjacent, finding that over 64,000 km^2 of wetlands may be non-adjacent based on our distance-based measure. This equates to approximately 15% of the freshwater wetland resources of the United States, using current estimates of national wetland extent. Altering the distance-based measure, as expected, decreased the extent of potentially non-adjacent wetlands, with greater impacts in areas with high stream densities. On-going improvements to the methodology include using lotic system hydrogeomorphology to better determine floodplain extent.

P-216: A BAYESIAN MULTILEVEL MODEL FOR MICROCYSTIN PREDICTION IN LAKES OF THE CONTINENTAL UNITED STATES

Farnaz Nojavan, Betty Kreakie, Jeffrey Hollister

T17: Lakes and Wetlands

The frequency of cyanobacteria blooms in North American lakes is increasing. A major concern with rising cyanobacteria blooms is microcystin, a common cyanobacterial hepatotoxin. To explore the conditions that promote high microcystin concentrations, we analyzed the US EPA National Lake Assessment (NLA) dataset collected in the summer of 2007. The NLA dataset is reported for nine eco-regions. We used the results of random forest modeling as a means of variable selection from which we developed a Bayesian multilevel model of microcystin concentrations. Model parameters under a multilevel modeling framework are eco-region specific, but they are also assumed to be exchangeable across eco-regions for broad continental scaling. The exchangeability assumption ensures that both the common patterns and eco-region specific features will be reflected in the model. Furthermore, the method incorporates appropriate estimates of uncertainty. Our preliminary results show associations between microcystin and turbidity, total nutrients, and N:P ratios. Upon release of a comparable 2012 NLA dataset, we will apply Bayesian updating. The results will help develop management strategies to alleviate microcystin impacts and improve lake quality.

P-217: FRESHWATER SPONGES AS PALEOLIMNOLOGICAL INDICATORS IN VOLO BOG

Grace Cocking

T17: Lakes and Wetlands

Volo Bog Nature Preserve has one of northeastern Illinois's most unique wetlands, containing naturally acidic water with pH ranging from 5.7-6.2. The wetland originated as a kettle lake and is now ringed by a floating mat of Sphagnum moss. To investigate how the wetland developed, we collected an 8.5-m sediment core and analyzed siliceous spicules of sponges preserved in the sediment. Three types of spicules (skeletal support structures) were well preserved throughout the sediment core. Megascleres (large supportive structures) were most common, but microscleres, and gemmoscleres, were also present. Anheteromeyenia ryderi and Spongilla lacustris were present at all sediment depths analyzed. A. ryderi is an acidic indicator, suggesting the wetland was acidic throughout the entire ~6300 years spanned by the sediment core. In continuing research, spicules of A. ryderi and S. lacustris will be quantified, to determine if relative abundances change over time. Sponge spicules are thicker, thus more resistant to dissolution than are diatoms, allowing sponge spicules to be used as paleolimnological indicators when diatoms are absent.

P-218: LINKING DECOMPOSITION TO METHANE PRODUCTION IN ALASKAN PONDS

Julia Hart, Carmella Vizza, William West, Gary Lamberti

T17: Lakes and Wetlands

Increasing global temperatures may enhance methane (CH4) production in aquatic ecosystems by accelerating microbial metabolism, altering dissolved oxygen patterns, and enhancing plant growth that provides carbon for methanogens. We assessed CH4 production in nine ponds on the Copper River Delta, Alaska via sediment incubations. To elucidate CH4 assimilation pathways during decomposition, we provided substrate (3.0g of lily - Nuphar polysepalum) and manipulated oxygen concentration in two treatments: anoxic and oxic. We used carbon stable isotopes to track changes in delta13C of the decomposing lily substrate. The anoxic treatment had significantly higher CH4 production rates than the oxic treatment ($p<0.001$). Although treatments did not differ in delta13C, CH4 production was a significant predictor of the change in delta13C during decomposition ($p=0.011$). Changes in delta13C values were also correlated with oxic methanogenesis ($r=-0.73$; $p=0.025$), suggesting that the amount of CH4 produced limits its oxidation and assimilation during decomposition. Understanding this relationship sheds light on processes that govern an ecosystem highly susceptible to climate change and better illuminates how CH4 dynamics impact wetland foodwebs.

P-219: IS THERE EVIDENCE OF EUTROPHICATION IN VOLO BOG NATURE PRESERVE? A PALEOLIMNOLOGICAL STUDY WITH DIATOMS

Charles Sandusky, Jennifer Slate

T04: Aquatic Ecosystem

Volo Bog Nature Preserve in northeastern Illinois is threatened by increasing suburban sprawl encroaching on its borders. To determine if the Sphagnum wetland has become more eutrophic, we collected a sediment core and analyzed diatoms preserved over time. Diatom species composition showed no apparent patterns from the bottom to the top of the core, which is estimated by radiocarbon dating to span several hundred years. The most common diatom species throughout the core, Gomphonema gracile and Encyonema silesiacum, thrive at low to moderate nutrient levels. Thus, we did not find evidence of recent eutrophication. In continuing research, diatoms will be analyzed in a sediment core spanning the past 6300 years, to determine if longer trends in eutrophication occurred as the bog developed over time.

P-220: CHIRONOMIDAE (DIPTERA) COMMUNITY RELATIONS TO STREAM HABITATS IN THE MISSOURI OZARK REGION

Rachel Heth

T18: Invertebrate Ecology

Finer taxonomic resolution of Chironomidae is not pursued because of processing difficulty and the frequent lack of community interpretational gain. Benefits of finer taxonomic data is increasing when analyses include multivariate techniques. Chironomidae from ten tributaries flowing into the Current and Jacks Fork rivers, Missouri, USA were collected using a Brown sampler from two tributary types and multiple mesohabitats. Univariate and multivariate tools were incorporated to examine whether or not Chironomidae genera change community-environmental relationships. Non-metric multidimensional scaling was used to explore community trends. Forty-eight genera of Chironomidae were collected and tributary or mesohabitat-scale community relations were not altered. Subfamily densities of Tanypodinae and Chironominae differed among mesohabitats being higher in pools and riffles of surface-fed tributaries than in spring-fed. Common Chironomidae densities related to environmental measures reflecting dependence upon fine substrates and food resources. These data indicate Chironomidae genera add critical understanding to Ozark stream ecology. Applications to eutrophy and land cover are present to aid in early detection of environmental threats.

P-221: IDENTIFYING HOTSPOTS OF BENTHIC INVERTEBRATE ABUNDANCE IN LAKE WINNEBAGO, WI

Courtney Heling, Robert Stelzer, Mamadou Coulibaly, H. Gene Drecktrah, Ryan Koenigs

T18: Invertebrate Ecology

Benthic invertebrates play important roles in aquatic ecosystems. Chironomids, for example, comprise approximately half of the carbon assimilated by lake sturgeon (Acipenser fulvescens) in Lake Winnebago, the largest inland lake in Wisconsin. However, little is known about the spatial distribution of chironomids and other benthic invertebrates throughout the lake. Our objectives were to observe where invertebrates were most densely clustered and to determine which physical characteristics were correlated with their distribution. We collected invertebrates and measured sediment characteristics at 45-60 locations at various depths and substrates throughout the lake in August of 2013 and 2014. We will use GIS and spatial statistics to identify spatial variation in invertebrate abundance within and between years and to determine associations between taxonomic diversity and physical factors. Preliminary results indicate areas of increased chironomid and total invertebrate abundance in the northeastern portion of the lake. Additionally, the littoral and profundal sites differ in the dominant invertebrate taxa present. A better understanding of the spatial distribution of benthic invertebrates in lakes may be useful for predicting impacts of primary consumers on higher trophic levels.

P-222: AQUATIC INVERTEBRATE COMMUNITY CHANGES OVER TWO DECADES IN RELATIVELY UNDISTURBED STREAMS IN NORTHERN MICHIGAN

Corey Krabbenhoft, Ashley Burtner, Donna Kashian

T18: Invertebrate Ecology

Understanding human driven changes in aquatic ecosystems is often hindered by a lack of long term data. Where data is available, it provides an invaluable baseline to which new sampling efforts can be compared. We conducted monitoring on 26 streams in northern Marquette County, Michigan from 2008 to 2012. We used proportional abundances of invertebrate taxa to compare the functional feeding group (FFG) composition of invertebrate communities between streams during five years of sampling. We compared these data to previously published data from 1992 and 1993 to elucidate changes in trophic structure over time. Stream-specific FFG makeup changed over the two decades since the reference study. Gatherers remained the dominant FFG in the Salmon Trout River but were proportionally less abundant, while the percentage of shredders increased from 3% to 29%. Among-stream differences in FFG composition were more evident in recent sampling, with the Yellow Dog River dominated by scrapers (47% as opposed to 23% in the Salmon Trout). Further land use and stream chemistry analyses will be necessary to investigate the drivers of shifts in aquatic invertebrate community structure.

P-223: DEVELOPMENT OF AN INTEGRATED METRIC INDEX (IMI) FOR HAWAIIAN STREAM ECOSYSTEMS

Antonio Garcia, Mishal Al-Wathiqui, Keith Krukowski, Laura Fields-Sommers, Tarek Teber, Nicklaus Neureuther, Stephen DeVilbiss, Timothy Schierenbeck

T18: Invertebrate Ecology

The Hawaiian Islands have the most unique, geographically remote, freshwater streams in the world, however, human activities, invasive species and climate change threaten the integrity of these ecosystems. Monitoring the health of Hawaiian streams is crucial to their preservation, but additional research is needed to properly assess the quality of Hawaiian streams. In January 2015, a study on the island of Hawaii was conducted to understand the ecological and physicochemical characteristics of two interior Hawaiian streams. Drift samples were collected hourly to quantify native shrimp, Atyoida bisulcata, (Hawaiian name: 'O'pae kala'ole), dispersion and downstream recruitment, as well as the associated macroinvertebrate community. Neonate shrimp larvae composed the largest proportion of nocturnal drift in the streams. The drift community suggested that an integrated metric index would be beneficial as an indicator of stream health and serve as a tool for continued monitoring and assessment.

P-224: INVERTEBRATE COLONIZATION OF LIVE VERSUS DEAD LARGE WOOD OF DIFFERENT SPECIES IN A GRAVEL BED STREAM

shrijeeta ganguly, Victoria Liddle, Arthur Brown

T18: Invertebrate Ecology

Submerged large wood plays an important role in structuring the invertebrate community of some stream ecosystems. Our purpose was to determine whether live and dead wood of different species is preferred by different invertebrates. Invertebrate colonization of wood was measured in a pool of a perennial first order gravel-bed stream in Arkansas after an inundation period of nine months. Logs (15x50 cm) used for this study were from live and dead loblolly pine (Pinus taeda) and white oak (Quercus alba) trees of comparable age and size. The dead wood was cut from trees killed by an ice storm in January 2009. The invertebrate community structure varied significantly across all wood types. Leptophlebiids were significantly more dense on both live and dead pine ($p = 0.028$); while gastropods were significantly higher on dead oak ($p=0.009$). Ceratopogonids, amphipods, rotifers, chironomids, and tardigrades were significantly more abundant on live pine logs ($p < 0.05$). Thus we conclude that wood characteristics may play an important role in structuring the invertebrate community in streams.

P-225: DISTRIBUTION OF MEIOFAUNA WITHIN RIFFLES

Melissa Welch, Nicole Prescott, Arthur Brown

T18: Invertebrate Ecology

The spatial distribution of benthic meiofauna in the head and tail regions of riffles was examined in six gravel riffles from two first order tributaries in the Illinois River, Arkansas. The purpose of this study was to see if a bias existed in the abundance of meiofauna within a riffle, like it does for macroinvertebrates. Three with the volume-250ml sediment cores were taken from both the head and tail of the riffle at each site. Meiofauna taxa (especially rotifera, nematoda, oligochaeta and cladocera) were abundant in the upstream and downstream ends of each riffle. There were no conclusive results indicating that meiofauna had a biased distribution within riffles. Certain taxa had significantly higher relative abundance than other taxa, but they were not significantly different between upstream and downstream ends of riffles. Unlike macroinvertebrates, meiofauna apparently do not exhibit a bias toward the upstream and downstream ends of a riffle.

P-226: EVALUATION OF FACTORS CONTROLLING METHANOGENS AND METHANE-OXIDIZING BACTERIA ON HYDROPSYCHID CADDISFLY RETREATS

Matthew Monteverde, Anne Hershey

T18: Invertebrate Ecology

Biogenic methane is produced in aquatic sediments by methanogenic Archaea (MET), and captured by methane-oxidizing bacteria (MOB), thereby cycling methane into food webs. Preliminary work has shown that net-spinning caddisfly (Trichoptera: Hydropsychidae) retreats support MET and MOB, which are consumed by hydropsychids. We evaluated whether these microbes are incidental on retreats (captured during filter feeding), or if retreats facilitate their growth. MET populations on retreats were strongly related to both seston and sediment concentrations for Hydropsyche, but only to sediment concentrations for Cheumatopsyche. MOB populations on retreats were positively related to seston concentrations for Hydropyche and sediment concentrations for Cheumatopsyche. These differences may reflect differences in retreat construction and stream microhabitat. In a lab experiment, hydropsychid gut and net MOB densities were highest in the experimental treatment containing sediment plus methane, and lowest in the treatment with no sediment and equilibrium methane concentration. These results suggest that retreats facilitate MOB growth, but that sediment may be needed to establish or maintain MOB populations on retreats.

P-227: LARVAL FISH PREDATION AND FLOW CESSATION EFFECT BENTHIC AND PLANKTONIC MEIOFAUNA RELATIVE ABUNDANCE AND SIZE IN ARTIFICIAL POOLS.

Laura Berryman, Arthur Brown

T18: Invertebrate Ecology

Eight artificial pools were placed in a 3rd order reach of the Illinois River in northwest Arkansas and allowed to colonize for 9 days. Benthic core and planktonic samples were taken daily. Water flow was stopped, local larval fish were added to half the pools, and sampling continued for one week. Both benthic and planktonic samples showed different dominant taxa in fish and fishless pools. Planktonic samples displayed significant differences in overall meiofauna counts but benthic samples did not. MANOVA testing of mean length in planktonic samples for fish/fishless treatments found effects of both taxa and fish treatment individually, but no overall interaction. Comparison of mean length in benthic samples found only an effect by taxa. Both benthic and planktonic samples from flow/no flow treatments showed significant differences in relative abundance. Fish predation influenced both meiofauna assemblage and meiofauna size in artificial pools but had more marked effects on planktonic meiofauna. Flow regime also had an effect on taxonomic composition.

P-228: POST-FIRE PULSES OF AQUATIC PRODUCTION: INVESTIGATING MIDTERM EFFECTS OF HIGH-SEVERITY FIRE ON HEADWATER STREAMS OF THE KLAMATH MOUNTAINS (SISKIYOU COUNTY, USA)

Emily Ferrell, Alison O'Dowd

T19: Land-Water Interfaces

Many studies have explored the impacts of riparian wildfire on aquatic ecosystems, yet knowledge of the mechanisms underlying these changes is still developing. In the face of future warming trends, insight into wildfire's effects is crucial for northwestern California's salmon-bearing streams. To investigate midterm (5-10y after fire) changes to these ecosystems, benthic macroinvertebrate (BMI), periphyton, and channel morphology data were collected from 21 stream reaches (30-50m) in 7 mid-Klamath watersheds that burned or escaped a 2008 wildfire. Stratified sampling allowed comparison of 5 unburned, 5 low severity, 6 moderate severity, and 5 high severity-burned streams. Analysis of chlorophyll a concentrations using mixed effects linear modeling identified an interaction between burn severity level and proportion canopy cover as the best predictor of periphyton production ($p<.001$). Periphyton productivity of streams burned at high severity was negatively related to proportion canopy cover ($R2=0.47$, $p<.01$), while other severity levels showed insignificant relationships, suggesting a significant effect of high severity fire on in-stream production. These results help to advance our understanding of the post-fire trajectory of aquatic ecosystem recovery.

P-229: AN EMERGING DECLINE: LARGE CONSUMERS REDUCE AQUATIC INSECT EMERGENCE BY AN ORDER OF MAGNITUDE IN A MISSOURI RIVER BACKWATER

Jerry Warmbold, Jeff Wesner

T19: Land-Water Interfaces

As fish communities change, due to species loss and species introductions, it is important to understand how fish communities affect links between aquatic and terrestrial habitats. We tested the hypothesis that fish reduce insect emergence from a Missouri River backwater near Wynot, NE. We measured ambient emergence from the backwater, which contained a mix of native and introduced species, including large Asian Carp. We also measured emergence from enclosures containing a density gradient of juvenile sunfish and Smallmouth Buffalo. Preliminary results indicate that insect emergence increased by an order of magnitude within enclosure treatments (78.7 mg/m2/day wet mass) compared to the ambient backwater (8.2 mg/m2/day). Twenty five days after enclosures were deployed macrophyte biomass was significantly higher within enclosures than in the ambient backwater, where it was essentially absent. Although the juvenile fish within the enclosures consumed some insects, a greater degree of macrophyte reduction and insect consumption occurred within the species rich backwater. Results suggest that large consumers are reducing insect emergence by an order of magnitude in the backwater through a combination of indirect herbivory and direct predation.

P-231: LONICERA MAACKII RIPARIAN INVASION IMPACTS MACROINVERTEBRATES BIOMASS AND SECONDARY PRODUCTION IN A HEADWATER STREAM

Claudia M. Garner, Rachel E. McNeish, M. Eric Benbow, Ryan W. McEwan

T19: Land-Water Interfaces

The impacts of the invasive riparian shrub Lonicera maackii (Amur honeysuckle) on aquatic macroinvertebrate secondary production were studied in a headwater stream. Macroinvertebrates were sampled monthly from August 2010 – December 2014 along two stream reaches: riparian honeysuckle removal and an up-stream honeysuckle reach. Macroinvertebrates were identified to genus and length-mass allometric equations were used to estimate biomass. Preliminary results indicated macroinvertebrate biomass was not statistically influenced by the removal of honeysuckle; however, interesting patterns were observed. Removal of honeysuckle was associated with 6× less macroinvertebrate biomass in the removal reach compared to the honeysuckle reach. Hydroptila sp. and Ceratopsyche sp. contributed the most biomass in the honeysuckle reach whereas Cheumatopsyche sp. and Planariidae were the dominant biomass contributors in the removal reach. Shredders dominated the functional feeding group biomass and were 97% greater in the honeysuckle reach than the removal reach. These preliminary results indicate removal of a riparian invasive plant species may result in changes in macroinvertebrate biomass at the taxonomic and functional level, potentially impacting stream ecosystem function and processes.

P-232: THE REMOVAL OF A RIPARIAN FOREST INVADER (LONICERA MAACKII) ALTERS MACROINVERTEBRATE ABUNDANCE AND DYNAMICS

Patrick Vrablik, Rachel E. McNeish, M. Eric Benbow, Ryan W. McEwan

T19: Land-Water Interfaces

We investigated the effects of the invasive riparian shrub, Lonicera maackii (Amur honeysuckle), on macroinvertebrate density, diversity, and functional feeding group dynamics in a headwater stream. In August 2010, riparian honeysuckle was removed along a 160m stream reach creating removal and upstream honeysuckle-present treatments. Macroinvertebrate Surber samples were collected monthly from August 2010 – December 2014. Specimens were identified to genus and classified into functional feeding groups (FFG). Preliminary results indicated macroinvertebrate taxon richness increased in the removal reach a year later ($P = 0.0279$). Further, total macroinvertebrate density was greater in the removal reach, and appeared to be driven by a significant increase in Simuliium sp. ($P = 0.0365$) in the fall and Chironomidae and Hydroptila sp. larvae and pharate adults in the summer (all $P < 0.0002$). Gathering-collectors and filtering-collectors dominated the FFG and were significantly greater in the removal reach ($P < 0.01$). These findings suggest that the removal of a riparian invasive shrub alters the density and taxon richness of aquatic macroinvertebrate populations, potentially impacting macroinvertebrate community dynamics and stream ecosystem processes.

P-233: FIELD MEASUREMENTS OF MICROCYSTIN IN THE MAYFLY HEXAGENIA LIMBATA DURING EMERGENCE, IMPLICATIONS FOR TOXIN TRANSFER AND PERSISTANCE

Megan Woller-Skar, Amy Russell, Mark Luttenton

T19: Land-Water Interfaces

Microcystin (MC) is a hepatotoxin produced by some species of cyanobacteria. Research has documented the accumulation of MC in a number of species including Hexagenia mayflies (Smith et al. 2008) and its transfer from aquatic to terrestrial systems (Miller et al. 2010). In 2013, we documented MC in adult Hexagenia limbata during emergence from an oligotrophic lake in Leelanau County, Michigan, USA (Woller-Skar et al. submitted). Based on these findings, the purpose of the current study was to quantify MC in Hexagenia limbata subimagos, eggs, and spent females. We collected samples of these life stages in June 2014 from the same site as previous years and quantified MC equivalents using enzyme linked immunosorbent assay with a hybridized extraction procedure similar to that of Wilson et al. (2008) and Poste et al. (2011). Preliminary results indicate that subimagos (144,000–1,238,000 pg/g dw), eggs (> LOD) and spent females (293,000–1,215,000 pg/g dw) contained MC. In the upcoming weeks, additional ELISA and high performance liquid chromatography/mass spectroscopy will be conducted using the remaining samples (n=5 per stage) to clarify potential implications.

P-234: ASSESSING SHORELAND HEALTH USING REPRODUCIBLE METHODS

Nancy Turyk, Dan McFarlane

T19: Land-Water Interfaces

Assessment and mapping methods were developed to evaluate and characterize shoreland health using a combination of field observations, aerial photos, and GIS to interpret shoreland features. The design of this whole-lake shoreland assessment was based on the National Lake Assessment, with observations and data collected from a boat. A menu of attributes was developed with selection dependent on the lake's setting, extent of shoreland disturbance, and desired use of the data. For all 75 lakes, geo-referenced attributes included vegetated buffer depth, ground conditions, canopy, and disturbances such as erosion, armoring, docks, structures, and outfalls. The carefully crafted maps illustrating these data provide an opportunity to interpret shoreland health from a more objective perspective and can be an effective means to communicate results to property owners. The results of the assessment can be utilized to identify problematic segments, focus education and assistance to properties most in need, track changes over time, and develop work plans for professional staff. These results may also be used in the development of strategies in lake and municipal plans.

P-235: AQUATIC DERIVED MICROCYSTIN ACCUMULATION IN LIVERS OF THE TERRESTRIAL COMMON CORMORANT (PHALACROCORAX CARBO), SAGINAW BAY, LAKE HURON

Jacob Gaskill, Amy Russell, Mark Luttenton, Megan Woller-Skar

T19: Land-Water Interfaces

Microcystin is a harmful hepatotoxin produced by several groups of cyanobacteria. Its adverse effects on humans and livestock are well documented (Carmichael 1994) and it is known to accumulate in fish from all trophic levels (Poste et al. 2011). However, accumulation of this toxin is understudied in terrestrial organisms and there is much to learn about its role in terrestrial-aquatic interactions. Here, we examine microcystin concentrations in the livers of common cormorants (Phalacrocorax carbo) collected in the summer of 2014 from islands within Saginaw Bay, a location where toxic algae blooms are common (Vanderploeg et al. 2001). Cormorants were chosen as they commonly accumulate harmful substances (Nakayama et al. 2006) and because they bridge the gap between aquatic and terrestrial ecosystems. Microcystin was quantified using enzyme linked immunosorbent assay (Envirologix), with a hybridized extraction procedure similar to those of Wilson et al. (2008) and Poste et al. (2011). Initial analyses reveal concentrations ranging from 6,495.69 pg/g to 41,024.73 pg/g dry weight (mean = 14,983.64 pg/g ± 5,738.25), suggesting that microcystin is able to transfer from aquatic to terrestrial ecosystems.

P-236: A NOVEL APPROACH TO SIMULATING HYPORHEIC INFLUENCES ON STREAM CHANNEL TEMPERATURE

Katie Fogg, Geoffrey Poole, Scott O'Daniel, Ann Marie Reinhold, Robert Payn, Sam Carlson, Amanda Hyman

T20: Hydroecology

Simulation models predict stream temperature by integrating heat exchange among the atmosphere, channel, and river substrate. Heat exchange across the stream bed occurs via conduction and advection, yet many models simulate 'effective conduction' of heat by representing conduction and advection with a single conduction equation. In montane alluvial streams, advection via hyporheic exchange dominates heat exchange across the stream bed. Therefore, parsimony would suggest using an advection equation to represent heat exchange. Employing a simple advection equation, we created an integrated model of stream and hyporheic temperature that simulates the temperature of, and heat exchange among, the channel and multiple hyporheic sub-zones defined by mean residence times. Thus, our model conceptually represents the diversity of temperature that occurs over space and time within expansive hyporheic zones of montane alluvial streams. In doing so, our model simulates hyporheic damping of both diel and seasonal variation in channel temperature – a capability absent from models that track only the mean temperature of the hyporheic zone.

P-237: A LANDSCAPE GENETICS APPROACH TO EXAMINE THE EFFECTS OF STREAM RESTORATION ON BIODIVERSITY IN COASTAL MASSACHUSETTS

Thomas Dimino

T21: Molecular Ecology

Anthropogenic alterations are known to stress stream systems and cause loss of biodiversity. Stream restoration projects are often conducted as a response to impact and therefore may restore biodiversity to a preimpact state. In this study, we propose that by looking at changes in population genetics of four taxa with differing dispersal strategies before, during, and after restoration, we will better understand if, how, and at what rate genetic diversity changes occur in response to restoration. To achieve this, we will sample over a 3-year period across three treatments: a system-wide restoration, a reach restoration, and a pristine reference site. We will use next-generation sequencing techniques to calculate nucleotide diversity in each population within each treatment. We expect to find that genetic diversity is greater at the reference site than the restoration stations, and restored site stations will gradually increase in genetic diversity after restoration. By taking a landscape genetics approach to measuring the efficacy of stream restoration, it will be possible to understand how restorative changes in landscape are affecting genetic structure of communities within a stream system.

P-238: SURVEYING THE PRESENCE OF WOLBACHIA IN THE MISSOURI RIVER ECOSYSTEM

Eric Sazama, Jeff Wesner

T21: Molecular Ecology

Wolbachia is a genus of alpha proteobacteria found within the reproductive systems of roughly 40-60% of all insects. These bacteria often act on their host by causing cytoplasmic incompatibility, parthenogenesis, feminization, and male-killing. Due to the ability of these bacteria to reduce populations of insects, they have been proposed as a method for controlling populations of disease causing mosquitoes that harbor Dengue fever and Malaria. The risks of introducing these bacteria into populations of insects may be an incidental infection of nearby insects that serve a vital role in the food web. Assessing this risk requires knowledge of the distribution of Wolbachia among aquatic insect species, which is currently lacking. Our preliminary survey of Wolbachia in two Missouri River tributaries shows that five out of 15 species have tested positive for Wolbachia. The orders Odonata, Trichoptera, Diptera, and Plecoptera have individuals infected with Wolbachia. Infection rates of species vary from 0.2 to 0.9 in species where more than one individual was tested, suggesting partial infection is common. More individuals are expected to be infected with Wolbachia as more testing progresses.

P-240: DEEP RELATIONSHIP BETWEEN GENETIC STRUCTURE AND GEOLOGICAL HISTORY OF JAPAN?S ENDEMIC DIPTEROMIMID MAYFLIES, WHICH INHABIT THE UPPER HEADWATERS (EPHEMEROPTERA, DIPTEROMIMIDAE)

Masaki Takenaka, Koji Tojo

T21: Molecular Ecology

The family Dipteromimidae is the smallest group of mayflies, with only two described spcies, and is endemic to Japan. As dipteromimid mayflies adapt in the generally narrow headwaters of rivers, populations are limited and generally relatively small in size. That is, populations tend toward miniaturization, and so are usually scattered and isolated, with a patchy distribution. As a result, the potential for gene flow between populations is strictly limited, and so there is a higher potential for genetic differentiation between populations, and the influence of random genetic drift is high. Hence, we particularly note that the degree of genetic differentiation relative to geographical distance is large. With regard to the results of our genetic analysis, even though genetic diversity in Honshu is in fact extremely high, still some local populatios are genetically isolated. The significance of the genetic distance to geographical distance has been shown in the results of a pair-wise distribution analysis (Mantel test, $p<0.001$). In this presentation, we outline the higher-level phylogenetic relationships relative to the geological history of the Japanese Archipelago.

P-241: BIOGEOGRAPHY OF EAST ASIAN EPHEMERELLID MAYFLIES, GENUS DRUNELLA AND CINCTICOSTELLA, INFERRED FROM MOLECULAR PHYLOGENETIC ANALYSES (INSECTA: EPHEMEROPTERA, EPHEMERELLIDAE)

JaeIck Jo, Koji Tojo

T21: Molecular Ecology

Ephemerellid mayflies inhabit widely in the basin on rivers. It is also well known that some species of this family co-inhabit in the same site, by their niche partitioning in microhabitat level. In this view points, the comparison and discussion of their population structure and genetic structure are very interesting. In this presentation, we will introduce for our genetic analyses of several species of Ephemellidae. The genus Drunella and Cincticostella is distributed throughout the Palearctic, Oriental, and Nearctic regions. Larvae of them (spiny crawlers) inhabit to the location of flowing waters in a wide range from slow- to fast-flow, on a variable substrates of riverbeds. In this study, genetic analyses of the mtDNA COI region were performed, using specimens collected widely areas from the Japanes Archipelago, the Korean peninsula, and a part of the Russian Far East. Consequently, we examined and discussed the genetic relationships of these East Asian ephemerid mayflies.

P-242: DETERMINING THE IMPACTS OF TOXINS IN THE GREAT LAKES USING BIOMARKERS OF DREISSENID MUSSELS

Nicklaus Neureuther, Ed Johnson, Kimani Kimbrough, Annie Jacob, Rebecca Klaper

T21: Molecular Ecology

In this project we examined genomic biomarkers related to stress, reproduction, and general physiology in dreissenid mussels in locations known to be heavily contaminated sites that had been remediated, and those that had been determined to be less contaminated in the Great Lakes. This was in conjunction with NOAA's NCCOS Mussel Watch Program, which monitors chemical pollution of nearly 150 contaminants in the near shore zones of the Great Lakes. Under the GLRI this has included Areas of Concern (AOC) around the Great Lakes. Our research builds on the chemical presence information by adding information on the health of mussels within these Areas of Concern versus other long-term reference sites. This includes a multi-agency project in the Manistique AOC to identify the sources of PCBs contributing to high concentrations in localized areas of the AOC. Quantitative PCR was used to measure candidate biomarkers in relation to level and type of contamination. Our data indicate a distinct gradient for mussels from "clean" versus contaminated sites where PCB's in particular cause significant changes in MXR, the Multi Xenobiotic Resistance gene.

P-243: BACTERIAL COLONIZATION OF MICROPLASTIC PARTICLES IN THE GREAT LAKES

Maxwell London, Amanda McCormick, Timothy Hoellein, Sherri Mason, John Kelly

T21: Molecular Ecology

High concentrations of microplastic particles (<5mm) have been documented in marine habitats worldwide, raising concerns about their ecological impacts. Marine microplastic supports dense bacterial biofilms distinct in taxonomic composition from surrounding water, suggesting that microplastic may alter the microbial ecology of marine waters. We demonstrated similar concentrations of microplastic in the Great Lakes, but the effect of microplastic on microbial communities is unknown. In this study we explored bacterial colonization of 1) microplastic particles collected from Lake Michigan and Lake Erie, and 2) microplastic isolated from commercial products and incubated in the laboratory with Lake Michigan water. We used next-generation sequencing of bacterial 16S rRNA genes to reveal that microplastic-associated bacterial consortia from both lakes and the lab incubation were similar in taxonomic composition and were distinct from the communities in the associated waters. For example, microplastic consistently selected for a higher relative abundance of Pseudomonadaceae, which have been shown in previous studies to participate in plastic biodegradation. These results indicate that microplastic serves as a novel habitat for a distinct bacterial consortium within the Great Lakes.

P-244:

Lesley Merrick

T12: Bioassessment

This assessment describes the ecological conditions of perennial rivers and streams throughout Oregon based on data collected during the summers of 2008 and 2009 for the NRSA. The results presented represent water quality, biological, physical habitat, and human health indicators. The most widespread stressors to the ecological health of Oregon's rivers and streams were fish habitat complexity, riparian canopy cover, turbidity, and total phosphorus concentration. Relative Risk analysis shows degradation to streamside vegetation posed the greatest risk to the biology. While the extent of the human disturbance stressor in poor condition was low, 44% of stream kilometers were in fair condition. This is alarming, as a shift into poor conditions is expected to greatly affect the biology. Mercury was found in all 23 large river fish tissue samples. The banned pesticide DDT and it's degradation products were found at 21 out 23 sites. PCBs and PBDEs (flame retardants) were both detected at 17 of the 23 sites. While these compounds were detected, they were almost all under the various screening levels for toxicity levels to humans and aquatic life.

P-245: MACROINVERTEBRATE COMMUNITY DYNAMICS ACROSS A THERMAL GRADIENT IN THE SURFACE AND SUBSURFACE OF ICELANDIC STREAMS

Daniel Govoni, Bjarni Kristjansson, Jon Olafsson, Mark Wipfli

T23: Biodiversity

Food webs and invertebrate communities have been thoroughly studied in small streams, but there has been relatively little research done on the trophic linkages between subsurface and surface communities (i.e., within hyporheic habitats). Hyporheic habitats may play a major role in shaping stream food webs and are likely very susceptible to warming temperatures. Climate change and resource development could alter the trophic linkages between surface and subsurface habitats upon which stream food webs depend. Understanding these linkages better, in the face of increasing resource development and climate change, will help inform aquatic resource management. Our objectives are to determine 1) how water temperature influences invertebrate community assemblage, density, and diversity at the stream surface-subsurface interface, and 2) how hyporheic communities and processes influence stream food webs. We have studied streams on two spatial scales: landscape and catchment. At both scales, we selected streams with different thermal regimes and took samples from four stations within each stream. At each station, we collected surface and subsurface samples. Stable isotopes are being used for determining trophic position of invertebrates within the food web.

P-246: EFFECTS OF ENVIRONMENTAL HETEROGENEITY, ISOLATION, AND PRODUCTIVITY ON BETA DIVERSITY OF LITTORAL MACROINVERTEBRATES IN LAKE ECOSYSTEMS

Jacob Vander Laan, Charles Hawkins

T23: Biodiversity

We used littoral macroinvertebrate samples from 800 lakes in 37 ecoregions across the USA to assess how beta diversity (compositional dissimilarity among sites within a region) varied with regional environmental heterogeneity, isolation (lake density), and productive capacity (total nitrogen [TN] and total phosphorus [TP]). We then compared these patterns to findings from a similar study in streams. Beta diversity (adjusted for alpha diversity, gamma diversity, and region size) increased with habitat isolation, TP, and environmental heterogeneity. The positive effect of TP (range = 0-500 µg/L) on beta diversity plateaued at around 200 µg/L, suggesting that further nutrient enrichment would have little effect on beta diversity. These results imply that regional environmental setting influences community assembly processes and plays an important role in determining patterns of biodiversity. The mechanisms behind these relationships are complex, but likely involve the combined effects of region-specific differences in environmental filtering, dispersal ability, and assemblage instability associated with nutrient enrichment. The patterns observed in this study were similar to those observed for streams, suggesting that these results may be applicable to freshwater ecosystems in general.

P-247: THE IMPACT OF INTERNATIONAL WATER TREATIES ON TRANSBOUNDARY CONFLICT: A STUDY FOCUSED ON LARGE TRANSBOUNDARY LAKES

Victoria Lubner

T24: Water Policy

Lakes are the largest reservoir of available surface freshwater on Earth, representing an irreplaceable ecosystem, essential for all life. Despite the crucial need for these lakes, there has been minimal research focused on their health and security. There are over 1,600 transboundary lakes worldwide, which do not follow political borders and thus result in governance and management challenges. International water treaties have been cited to be a main mechanism for cooperation between riparian countries. This study researches the impact of international water treaties as well as economic, political, and environmental variables on transboundary water conflict between riparian countries of the 35 largest transboundary lakes. The goal is to understand if the implementation of an international water treaty impacts the occurrence of conflict between riparian countries of large transboundary lakes. Datasets were created from existing international water treaty and conflict databases focused on transboundary waters. The created datasets were used to analyze the relationship on a primary focus, annual, and lake basis. Furthermore, an event analysis of case studies was completed for each lake. There were 52 international water treaties, focused on joint management, water quality, and water quantity implemented between 1990 and 2013. Between 1990 and 2013, 53 international water conflicts occurred with the primary focuses of water quantity and border issues. The content of the treaty is an essential aspect to understand the effectiveness of preventing conflict after implementation; the majority, 28, of the 53 conflicts that occurred after a treaty was implemented were not related to the content of that treaty. The majority of the international lake treaties lack vital components for successful compliance including enforcement, conflict resolution, and monitoring. Overall, the implementation of a treaty does not result in a disappearance of conflict between riparian countries. The details of the treaty as they relate to the conflict are the best indicators of successful compliance and the occurrence of conflict.

P-248: CHRYSALIS TO IMAGO: BALANCING WETLAND SCIENCE AND TRIBAL COMMUNITY VALUES

Scott O'Daniel, Rudy Salakory, Darla Boyer, Tom Elliot, Tracie Nadeau

T24: Water Policy

Tribal uses of aquatic resources are constrained by dwindling wetland quality, acreage, and a common lack of understanding of the importance of these resources for tribal culture beyond Reservation boundaries. Tribal programs aimed at conserving resources for both ecosystem and cultural uses were lacking a venue for important regional networking and training. In response to this need, Tribes and EPA R. 10, organized the Tribal Wetland Working Group (TWIG) in 2009. The TWIG has held workshops and trainings that provided a path for Tribal wetland and aquatic resource staff to affect changes to Tribal resource management by integrating traditional Tribal uses of aquatic resources into wetland science, planning, and regulatory frameworks. These workshops illuminate the interconnected relationships between wetland conditions and cultural practices, and facilitate the exchange of ideas and practices with staff from other tribes. We continue to hold workshops, build organizational capacity, and encourage wetland programs that integrate tribal culture as the TWIG seeks to increase training opportunities for and communication among the Tribes of the Pacific Northwest.

P-249: MANAGEMENT PARADIGMS AND CONFLICT OVER WATER RESOURCES

Stephen McGuire, Timothy Ehlinger

T24: Water Policy

The combination of increased demand and climate change has placed stress on surface and groundwater systems and the communities who depend on them. To address the growing conflicts, governance and policy solutions are needed that promote adaptive management of water resources through social learning. This poster explores water policy management through the application of Social-Ecological Systems theory to a case-study conflict between the Lake Beulah Management District and the Village of East Troy over the use of a high capacity well. Lake monitoring studies and stakeholder focus groups were conducted to assess the resilience of the Lake Beulah social-ecological system. The monitoring studies indicate that Lake Beulah is resilient to short term hydrologic disturbance. However, it's unclear whether long-term chronic effects of pumping will result in Lake Beulah approaching some tipping point. Through systems mapping, stakeholder groups visualized the social-ecological system. Researchers then produced management paradigms from the resulting systems map. Creating a policy framework with alternative management paradigms will allow communities to learn from and adapt to changes in climatic conditions and water availability.

P-250: EXPLORING HOW CLEAN WATER ACT ENFORCEMENT INFLUENCES STREAM MACRO-INVERTEBRATE COMMUNITIES

Shelby Ward, Paul Armsworth

T24: Water Policy

Enforcement is a key feature of the Clean Water Act. The Clean Water Act's National Pollutant Discharge Elimination System (NPDES) permit program regulates effluent into streams that may impact aquatic life. Yet, authorities do not always enforce permits when violations occur. This research examines pre-existing macroinvetebrate survey data near NPDES permitted facilities in Kentucky and Tennessee to determine the influence of enforcement actions on aquatic biodiversity. Pre-existing data from 1997-2012 from the Environmental Protection Agency and state agencies was used to make quantitative and spatial comparisons. The multiple regression model controlling for state, population density and elevation showed no statistically significant relationship between enforcement and freshwater community indicators. After subsetting by stream order and ecoregion, statistically significant relationships were found. A significant relationship between enforcement and EPT taxon richness exists in fourth and fifth order streams ($p=0.042$). Enforcement and EPT taxon richness also had a significant relationship in an ecoregion subset encompassing the Mississippi Valley Loess Plains, Interior River Valleys & Hills, and Southeastern Plains ($p= 0.100$).