

XII NORTH AMERICAN PLECOPTERA SYMPOSIUM

XII North American Plecoptera Symposium 16-19 May 2019



It hardly seems possible, but the North American Plecoptera Symposium met for the 12th time in its history on 16-19 May 2019. This was the second time (1st 2006) it was held at the Springs Agricultural Experiment Station in the beautiful Shawnee National Forest of southern Illinois. Attendees totaled 19, a small but powerful group. We enjoyed 15 presentations. Attendees included Bill Stark, Charlie Nelson, Jane Earle, Boris Kondratieff, Scott Grubbs, Ed DeWalt, John Sandberg, Audrey Harrison, Luke Myers, Steve Beaty, Victor Holland, Chris Verdone, David Rees, Jason Robinson (a trichopterist!), and were most pleased to have four graduate students attend and present their work: Taylor McRoberts (WKU), Madeline Metzger (WKU), Eric South (U-IL), and Evan Newman (U-IL). Last but not least, we were well fed and organized for meals by the very efficient Lesley Deem (U-IL).

A significant development occurred at our business meeting. Dr. Charlie Nelson proposed that we postpone our next NAPS meeting until 2023 (not 2022). This would give NAPS members incentive to attend the international meeting without the added cost of a North American meeting in the next year. This would also provide some incentive for members to donate funds to Perla in order to support student travel grants.

We were treated to 15 presentations (see titles and abstracts below) that ranged from species descriptions, to state and regional faunistic studies, and proposals to rank imperilment for species in northeastern states. All presentations may be viewed from the

following link: double click on a presentation and then chose “Open with” and “Google Slides”, then under tab “View”, click “Present”:

<https://drive.google.com/drive/folders/1QvgeCOFTiugx5xuOBWeuJRBUYp-Z52o?usp=sharing>

1. A COLLABORATIVE NORTHEAST REGIONAL SGCN FOR STONEFLIES (INSECTA: PLECOPTERA)

R. Edward DeWalt, Illinois Natural History Survey. Luke Myers, Lake Champlain Research Institute. Boris C. Kondratieff, Colorado State University. Scott A. Grubbs, Western Kentucky University. Jane Earle, Mechanicsburg, PA.

We argue that insects in the order Plecoptera (stoneflies) are highly imperiled in the Northeast USA due to habitat destruction, urbanization, and most recently by changing climate and are worthy of protection and the funding necessary to formally establish their conservation status. Stonefly larvae inhabit streams of all sizes and some high latitude or altitude lakes. They are food for myriad predators and help to process organic matter. The adults feed both aquatic and terrestrial predators, but also transport nutrients and energy back to the terrestrial environment. These insects have poor dispersal capabilities and are highly sensitive to environmental changes and therefore are used as indicators of water quality. Range loss, extirpation, and extinction have been documented in many areas of the world, including several states in the USA Midwest and many locations in Europe. Climate modeling has predicted dramatic shifts northward for the distribution of stonefly genera in North America. At least 246 species of stoneflies are known from the 13 states in the US Fish and Wildlife Service (USFWS) Northeast Region. Species richness is concentrated in five large or altitudinally diverse states, ranging from 109 (MD) to 188 (VA). A unique consortium of stonefly scientists, state and federal biologists, and conservation organizers has formed and met remotely several times to generate a list of 33 Regional Species in Greatest Conservation Need (RSGCN). These 33 species form the basis of a USFWS Competitive State Wildlife Grant proposal currently being drafted to formally establish conservation status of species by gathering specimen data from literature, museums, and through rigorous fieldwork across the region in collaboration with local, state, and federal biologists. This presentation is being shared remotely with The NE Fish and Wildlife Diversity Technical Committee that is simultaneously meeting.

2. DRUMMING DESCRIPTIONS OF TWO STONEFLIES (*PTERONARCYS BILOBA* NEWMAN AND *ACRONEURIA FRISONI* STARK & BROWN) FROM NEW YORK STATE

Luke Myers, Lake Champlain Research Institute. John Sandberg, California DFW Aquatic Bioassessment Lab.

The drumming signals of two species of stoneflies from northeastern New York are described: *Acroneuria frisoni* Stark & Brown and *Pteronarcys biloba* Newman. *Pteronarcys biloba* intersexual exchanges were 3 way with decreasing varied beat interval call pattern similar to previous descriptions for males of this species from North America. We also provide the first drumming description of *Acroneuria frisoni*. Male calls consisted of a diphasic rub tap call with intersexual exchanges ranging from 2 to 3

way. Variables measured included, ambient air temperature, age of reared adults, interbeat interval pattern, number of beats per signal, rub duration, mean interbeat interval (call, answer and response), interval difference (ID) and call answer exchange interval (MFEI and FMEI). Charts providing the complete interval pattern and raw character data are included.

3. EFFECTS OF STREAM PERMANENCE ON STONEFLIES (PLECOPTERA) IN THE MAMMOTH CAVE REGION

Taylor McRoberts and Scott A. Grubbs, Western Kentucky University.

Protected natural areas (i.e. national parks) are important refuges for native flora and fauna. Understanding the distribution of species across environmental gradients can aid land managers in the creation of conservation and protection initiatives. Aquatic insects, including stoneflies (Insecta, Plecoptera), have evolved life history strategies to survive periods of extended, seasonal droughts. The objective of this study is to assess if stream permanence influences stonefly distributions in the Mammoth Cave Region, mainly at Mammoth Cave National Park (MACA). Several questions are being addressed, including:

1. How many species and what proportion of the regional pool are present?
2. Do biological traits of species correlate with habitats available?

Three collecting events have occurred across 44 unique sites from December 2018–March 2019. A timed, structured sampling design has been implemented based on a collection of adults for 30 minutes per site. Monthly sampling will continue through October. The number and types of sites chosen are intended to fully characterize the stonefly fauna across the full gradient of stream size and flow permanency patterns present, especially within MACA. Only 13 species have been collected through the first two sampling events, but several more are anticipated, especially in families Leuctridae and Perlidae, with spring and summer sampling. In addition, benthic sampling for stonefly larvae will occur in late winter-early spring 2020 to capture species that are typically less commonly-collected as adults.

4. ALTITUDINAL DISTRIBUTION OF PLECOPTERA (STONEFLIES) IN MOUNT MITCHELL STATE PARK AND PISGAH NATIONAL FOREST

Madeline Metzger and Scott A. Grubbs, Western Kentucky University.

Stoneflies are good water quality indicators due to their high sensitivity to organic pollution and environmental changes. A predicted temperature increase of 1.8–4.0 °C is expected by the year 2100. This increase will affect cold-adapted species due to a change in dissolved oxygen levels. Climate change is known to impact species ranges and can lead to summit traps in montane environments. Understanding which species exist across environmental gradients will allow for futuristic climate modeling, ultimately contributing to a variety of applications in ecology and conservation efforts. Mount Mitchell State Park and adjacent Pisgah National Forest provide a protected landscape with a ca. 1,000 km elevation gradient from which to sample species, many of which ranges could decrease or be lost altogether with increasing temperatures. At a minimum, the following questions will be addressed:

1. What portion of the regional species pool is present and why?
2. Do diversity hotspots exist? (e.g. specific stream size or elevation range)
3. Is there evidence of or potential for species loss over time?

Sampling efforts have occurred seasonally (spring, summer, fall and winter) from 2014–2017 and represent the broadest ranges of altitudes and stream sizes present within the sampling area. To date, over the course of 12 sampling trips, 41 species have been collected from 86 unique sites. More species are expected with further *Isoperla* identifications and sampling trips. Approximately 4–6 sampling trips are scheduled through 2019. Results to date are limited. Species altitude ranges using box plots were generated in R to assess how many species are habitat generalists versus specialists. Distributional data could be further mapped for temperature increases using Maxent software.

5. NOTE ON THE EGG OF *UTAPERLA GASPESIANA* (PLECOPTERA: CHLOROPERLIDAE)

Charles H. Nelson, University of Tennessee at Chattanooga.

The egg of *Utaperla gaspesiana* (Harper & Roy, 1975) is described and illustrated using scanning electron photomicrographs. Information on structure (general shape, cross-section shape and chorionic detail), color and egg and collar size is provided.

6. MOLECULAR PHYLOGENY OF THE NORTH AMERICAN PLECOPTERA

Eric J. South, R. Edward DeWalt, Boris C. Kondratieff, Rachel K. Skinner, Kevin P. Johnson, Mark A. Davis, Jonathan J. Lee, Richard S. Durfee

Stonefly phylogenetic hypotheses proposed since the mid-20th century have shown incongruence and/or unresolved relationships. The advent of Next Generation Sequencing (NGS) and genomics/transcriptomics provides a new opportunity to propose a well-supported and fully-resolved stonefly phylogenetic hypothesis. Transcriptomes, complete sets of RNA molecules which reflect all gene expressions in an organism at a specific point in time, contain protein coding sequences from which numerous phylogenetically informative genes can be selected to ultimately yield well-supported phylogenetic hypotheses. The primary objective of this study is to develop a robust phylogeny of the North American Plecoptera using multiple genes selected from transcriptomes. RNA transcripts have been assembled for 52 of the 109 North American genera, representing all nine families, 14 subfamilies, and 12 tribes. RNA extractions for an additional 27 genera have been prepared for sequencing.

7. HISTORICAL RECONSTRUCTION OF A ONCE DIVERSE FAUNA: STONEFLIES OF THE MIDWEST USA

R. Edward DeWalt¹, Scott A. Grubbs², Jason L. Robinson¹, Matt Yoder¹. ¹Illinois Natural History Survey. ²Western Kentucky University

Plecoptera are sensitive to water and habitat quality changes. Copious museum specimens allow for reconstruction of the Midwest stonefly assemblage. In Illinois long-lived, predatory species are in the process of being lost from a large portion of their range.

Similar losses are predicted for other Midwest states due dominance by agriculture and urbanizations. We used museum specimen data and recent collections to reconstruct the historical distributions, richness patterns, and assemblage structure of stoneflies in Iowa, Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. Specimens constituting 32,000 species-level records from 25 museums/agencies and recent collections were examined. Legacy records were georeferenced and the locations projected into United States Geological Survey Hierarchical Unit Code scale 6 (HUC6) watersheds. At least 154 species were recovered including several new and undescribed species with predictions to 162 species. Assemblage clusters resulted for unglaciated and nearby glaciated HUC6 drainages, a Great Lakes assemblage of drainages, and a prairie oriented assemblage. Richest HUC6 drainages were in unglaciated landscapes of eastern latitudes and higher slope, wooded HUC6s of the east and north. Naturally low richness areas also occurred. Lake Superior HUCs afforded refuge for several cold-water adapted species. These data will be used in the future to assess conservation status by species and state and distribution modeling of past and future ranges. Broader impacts include the training of several graduate and undergraduate students, the salvage of decades-old specimens from obscurity and decay, the identification of all specimens to current taxonomic standards, and the sharing of digital specimen records conforming to global data standards.

8. REFORESTING THE LOWER MISSISSIPPI RIVER: NEW EFFORTS TO PROVIDE SUBSTRATES FOR CLINGING INVERTEBRATES

Audrey B. Harrison, Army Corps of Engineers.

A novel study focusing on invertebrate colonization on natural and artificial riverine substrates is in progress in the Lower Mississippi River, USA. In February 2019, baskets containing different substrates were attached to buoys and deployed in a secondary channel near Helena, Arkansas. Retrievals were timed in three-week increments over a 12-week study period, in order to quantify colonization rates. Initial results indicate unexpected levels of invertebrate drift during this period, particularly for stoneflies, including *Hydroperla* and *Isoperla* (Plecoptera: Perlodidae). This study marks the beginning of a three-year study focused on Mississippi River invertebrates. Additionally, recent cooperation with river engineers and managers is promising for large river invertebrates, including stoneflies, mayflies, caddisflies, and true flies. Efforts to create wood jams in Lower Mississippi River secondary channels are ongoing. Herein, project plans are discussed, and suggestions welcomed.

9. PLECOPTERA OR STONEFLIES (INSECTA) OF INDIANA: DIVERSITY AND CONSERVATION STATUS OF SPECIES

Evan A. Newman and R. Edward DeWalt, Illinois Natural History Survey, Scott A. Grubbs, Western Kentucky University

Stoneflies (Plecoptera) are indicators of water quality and have been lost in dramatic numbers from Midwest states, including Indiana. This study synthesizes over 5,000 specimen level records from museums and recent fieldwork to build a current species list, assess watershed level species richness, and calculate state level conservation

assessments using NatureServe's Conservation Rank Calculator. Results include 1,050 positive occurrence records that yielded 92 species. Among these is one recently described species, a new species not yet described, and three previously described species new to Indiana. We have also found additional locations for rare species and confirmed the presence of a few species thought to be extirpated. United States Geological Survey Hierarchical Unit Code scale 6 (HUC6) drainages with the highest species richness values were the Patoka-White (73 species), Lower Ohio-Salt (60 species), and the Wabash River (57 species). The other seven drainages produced from five to 28 species, being limited by low gradient streams due to lake plain landscapes and by stream nutrient enrichment from agriculture. Eleven species were rated as extirpated or presumed extirpated, leaving 81 extant species. Of these, 17 were rated as critically imperiled (S1), 26 imperiled (S2), 25 vulnerable (S3), while only 13 species were rated as secure (S4 & S5). Watersheds and specific streams were discussed for their ability to support individual species or rich assemblages.

10. *Taeniopteryx harpi* (Plecoptera: Taeniopterygidae), a new species of willowfly from Quebec, Canada and New York state, USA

R. Edward DeWalt and Nicole Gamble. Illinois Natural History Survey

Dr. Peter Harper hosted DeWalt at his home in Montreal during March 2016 to prepare borrowed Leuctridae specimens for return to USA colleagues. Before leaving, Harper and DeWalt enjoyed three days of winter stonefly collecting from several locations in Quebec. This effort yielded a new willowfly. The name of the new species, *Taeniopteryx harpi* honors both Peter and Francois Harper for their many contributions to Plecoptera and aquatic insect science. The 9th sternum of the Males narrows at the midpoint rearward, forming an excavated posterior margin. The male paraprocts are unique in having a narrow basal sclerite and a detached, dorsally directed arm forming a short, apically curled tip. The female's subgenital plate is U-shaped with a sclerotized, semicircular plate that lacks the quadrate tab of other species. A new, potentially useful character is a darkly pigmented area on the head that encompasses the anterior ocellus. This pigment pattern is not known from other *Taeniopteryx*. We illustrate these characters using light microscopy. *Taeniopteryx harpi* is similar to *T. parvula* Banks, 1918 and *T. metequi* Ricker & Ross, 1968 with which it has been confused in the past. The type locality is the Riviere Doncaster, Ste-Marguerite-Du-Lac-Masson at Chemin du Ste-Marguerite, 46.02764, 74.06409. The species occurs in lower Quebec, adjacent to New York and Maine. It is likely to occur in other states and provinces near the USA/Canada border to the east.

11. 2021 XVIth International Conference on Ephemeroptera and XXIth International Symposium on Plecoptera in Fort Collins, Colorado, USA

Boris C. Kondratieff, Colorado State University, R. Edward DeWalt, Illinois Natural History Survey

A proposal to host the international mayfly and stonefly meeting in 2021 at the Mountain Campus of Colorado State University was presented at the 2018 meeting in Brazil. The proposal was enthusiastically accepted. The Mountain Campus is a high elevation (be

prepared) enclave west of Fort Collins that provides dormitory and private housing, a cafeteria, and conference facilities set in idyllic surroundings. Proposed inclusive dates are Sunday 25 July through 1 August. Registration will start the afternoon of the 25th, oral and poster sessions would be held 26-27 and 29-30. A group field trip will occur on the 28th. The conference wraps up business with a farewell banquet and awards ceremony will be held Friday evening the 30th. Stay another day for the post-conference trip (optional) on Saturday. A full program for accompanying guest is being planned with trips to local attractions. Local costs are moderate. Abundant volunteer opportunities exist! Please consider donating to *Perla* to support student travel costs. We hope to see all of you there.

12. *SOYEDINA* RICKER, 1952 (PLECOPTERA: NEMOURIDAE) IN THE EASTERN NEARCTIC REGION: REVIEW OF SPECIES CONCEPTS AND PROPOSAL OF MORPHOLOGY-BASED SPECIES GROUPS

Scott A. Grubbs, Western Kentucky University and Richard W. Baumann, Brigham Young University

The eastern Nearctic species of the genus *Soyedina* Ricker, 1952 (Plecoptera: Nemouridae) are reviewed. Morphology-based species groups are proposed based on characteristics of the epiproct.

13. PENNSYLVANIA CHLOROPERLIDAE

Jane Earle, Mechanicsburg, PA

The nineteen species of Chloroperlidae have interesting distributions, many based on ancient river basin connections and ecoregions. Few species are found in the Piedmont of southeastern Pennsylvania, due to the more extensive urban-suburban development, fewer forested area, and warmer waters. Only *Alloperla atlantica* Baumann, 1974, *Haploperla brevis* (Banks, 1895), and *Sweltsa onkos* (Ricker, 1936) have been collected from the southeastern Pennsylvania Piedmont. The Allegheny Front, which separates the Ridge and Valley from the Allegheny Plateau is also a major dividing line for species distribution. The Potomac River, part of the Chesapeake Bay drainage, shares several species with its ancient river connection to the present day Ohio River-Gulf of Mexico drainage. Several species are found in the Ohio River Basin plus the West and North Branch Susquehanna River drainages north of the Allegheny Front.

14. MITIGATING THE MORASS: THE STATUS OF *ISOPERLA* NYMPHAL-ADULT ASSOCIATIONS IN NORTH CAROLINA

Steven R Beaty, North Carolina Department of Environmental Quality

The number of known species of *Isoperla* in North Carolina was previously thought to be 30 species based on published records. However, three additional undescribed species are now thought to occur within the state and at least one more previously described species has also now been collected in North Carolina. This brings the total number of known *Isoperla* species to 34 within the state. Of these 34 species, we have reared and associated 24, 15 of which are new associations with the remaining associations confirming

published nymphal descriptions. The status, challenges, and goals of these rearing and collection efforts will also be discussed.

Examine specimens, discuss projects, ask questions, rest until dinner.

15. PRELIMINARY NOTES ON THE WINTER EMERGING STONEFLY FAUNA OF NORTH CAROLINA

Chris J. Verdone, North Carolina Department of Environmental Quality

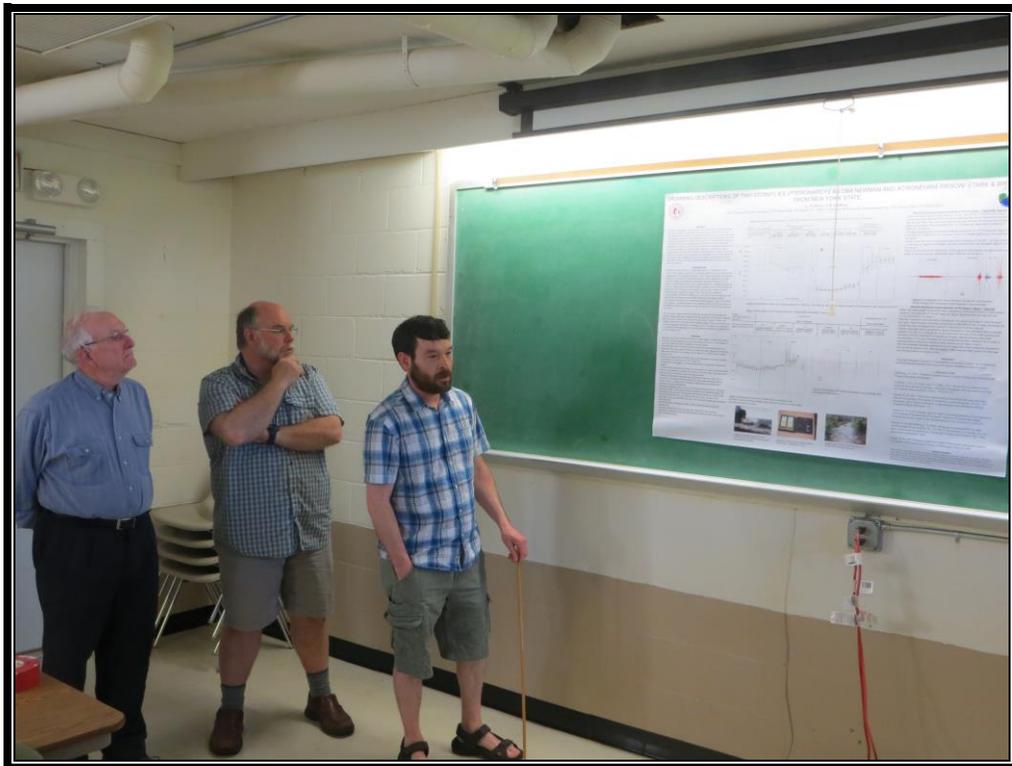
In the winter of 2018-2019, winter emerging stoneflies were collected from the various ecoregions of North Carolina. An overview of the winter emerging stonefly fauna of North Carolina is presented, including historical background, new distributional data, and the description of a new species of *Zealeuctra* Ricker. Data are given as photographs and maps.



Director of Operations, Dr. R. Edward DeWalt checking details during the meeting. Dr. Kondratieff, Luke Myers, Dr. Robinson, the future PhD Eric South, Steven Beaty, Chris Verdone, Jane Earle, Drs. Charles R. Nelson, Audrey Harrision, Bill Stark all paying close attention.



Dr. Audrey Harrison, U.S. Army Engineer Research and Development Center presenting her talk, with Drs. Charles R. Nelson, John Sandberg, Bill P. Stark, and Scott Grubbs listening to every detail.



Drs. Charles R. Nelson and R. Edward Dewalt scrutinizing Luke Myers' presentation.



Dr. Scott Grubbs presenting his review of the eastern Nearctic nemourid genus *Soyedina*.

ANNOUNCEMENTS

2021 XVITH INTERNATIONAL CONFERENCE ON EPHEMEROPTERA AND XXIST INTERNATIONAL SYMPOSIUM ON PLECOPTERA

Organizers: **Boris C. Kondratieff**, Colorado State University, Director C. P. Gillette Museum, 1177 Campus Delivery, Fort Collins, Colorado 80523, boris.kondratieff@colostate.edu. **R. Edward DeWalt**, Illinois Natural History Survey, 1816 S Oak St., Champaign, Illinois 61820, dewalt@illinois.edu

The dates of the meeting are Sunday 25 July through 1 August 2021. It will be held at the Mountain Campus, Colorado State University, Fort Collins, Colorado, USA. The meeting website will be up by Spring 2020. The site is a high elevation enclave west of Fort Collins, Colorado, about three hours North of Denver Colorado. The facility provides dormitory and private housing, a cafeteria, and conference facilities in an idyllic setting. There are no restrictions in regard to collecting insects and other invertebrates in the nearby mountain streams, ponds, and wetlands. The Ephemeroptera and Plecoptera fauna

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

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