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## The Mayfly Newsletter

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# The Mayfly Newsletter

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Winter 2018

The Mayfly Newsletter is the official newsletter of the Permanent Committee of the International Conferences on Ephemeroptera

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## Feature Photo



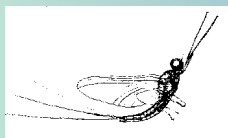
*Hexagenia* sp. (Ephemeroidea) in the morning dew, 29-VII-2018, USA: IN: Brown Co.: New Bellsville. LMJ, "collector."  
Submitted by Luke M. Jacobus, Indiana Univ., Purdue Univ., Columbus, Indiana, USA

## Conferences of interest

(submitted by Michel Sartori)

11th Symposium for European Freshwater Sciences-SEFS11  
SEFS11 will take place in Zagreb, Croatia, from June 30 to July 5, 2019.  
<http://www.sefs11.biol.pmf.hr/>

Society for Freshwater Science  
Salt Lake City, Utah, USA, May 19-23, 2019  
<https://sfsannualmeeting.org/>



The Mayfly Newsletter is published (on-line) at <https://dc.swosu.edu/mayfly/>  
(see link on Ephemeroptera Galactica: <http://www.ephemeroptera-galactica.com/>)

contact: Donna J. Giberson, Editor  
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## Feature Article

# Crabwalkers and sand minnows: Searching for psammophilic mayflies in the central and western states (& provinces)<sup>1</sup>

**Greg Courtney**

Department of Entomology,  
Iowa State University, Ames, Iowa, USA

Motivated by a number of collaborative photography projects with Steve Marshall (e.g., Courtney & Marshall, 2019), I have devoted a bit of time recently to searching for non-dipteran aquatic insects. Among the ongoing projects is a book on which I am not only lead author but in charge of several chapters focused on taxa outside my usual bailiwick (e.g., Ephemeroptera!). Thankfully, Steve has already established an excellent template for such a book (Marshall 2006: "Insects. Their Natural History & Diversity", which was recently (2017) published as a 2<sup>nd</sup> edition). His "Flies" (Marshall 2012) and "Beetles" (Marshall 2018) books are other outstanding contributions focused on specific taxa. So, using Steve's "Insects" book as a template, we have started working on a book on aquatic insects. We have a number of goals, with perhaps the most daunting being inclusion of images of live exemplars of ALL families of aquatic insects GLOBALLY. Because of this goal, I decided that a good starting point for the Ephemeroptera chapter was to see which North American families I still hadn't photographed. In developing this list, it was obvious that most "missing" families (e.g., Acanthametropodidae, Ametropodidae, Behningiidae, Pseudironidae) occur in shifting sand, a habitat I had rarely sampled. In fact, the only of these psammophilic (literally "sand-loving") families I'd ever even seen was Behningiidae, but I had seen these bizarre mayflies only in Thailand, and had never photographed a live nymph!

So it was apparent I'd have to deviate from my usual focus... torrential streams... and start visiting sand-bottomed rivers (Figs. 1 & 2). The fauna of these habitats includes a variety of interesting insects, and not just mayflies. Noteworthy among the non-mayfly taxa is *Progomphus*, a fairly common dragonfly across North America (including in Iowa). But the focus of my initial interest was mayflies. Because this was a novel habitat for me and some of these mayflies are considered quite rare, the task seemed especially daunting. This prompted me to consult with several experts, notably Boris Kondratieff, Colorado State University, and Dennis Lehmkuhl, formerly at University of Saskatchewan. Both graciously recommended a number of potential collection sites and advice on how to find these mayflies.

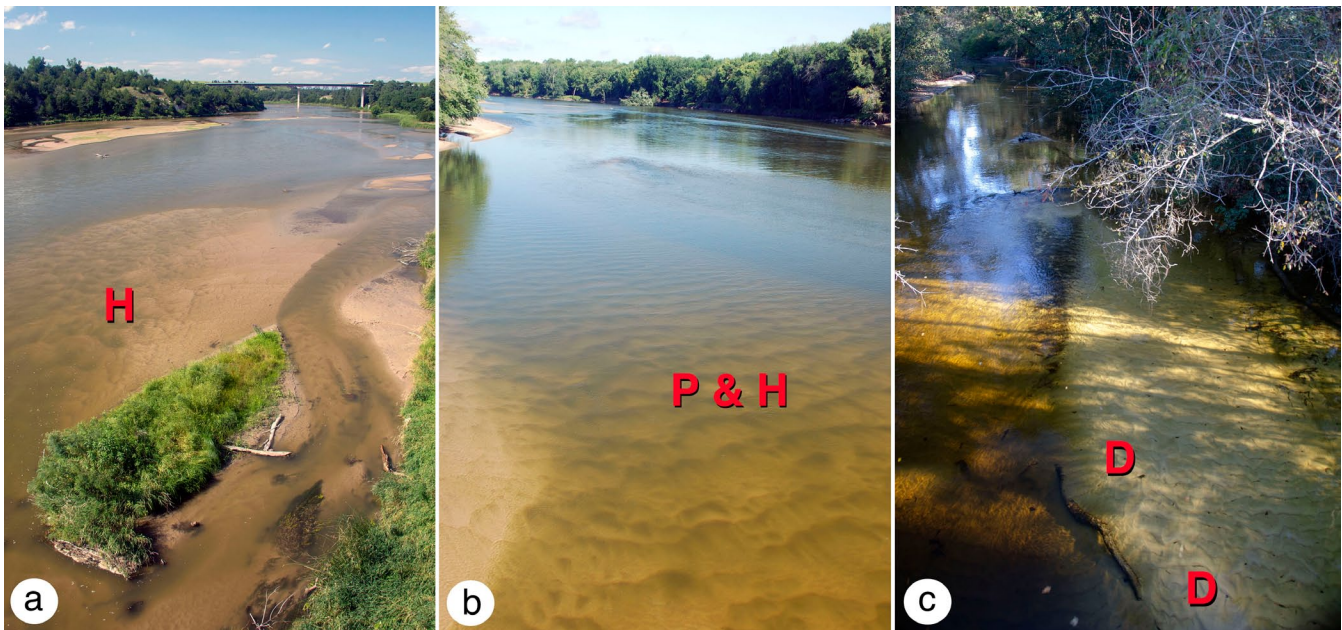


Figure 1. Habitat for psammophilic mayflies: a, Niobrara River, Nebraska; b, Cedar River, Iowa; c, upper Blackwater River, Florida. Abbreviations: H, *Homoeoneuria*; P, *Pseudiron*; D, *Dolania*.

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<sup>1</sup> This article is reprinted from the Newsletter of the Biological Survey of Canada, Vol. 37(2), Winter 2018 (<http://biologicalsurvey.ca/pages/read/newsletters>)

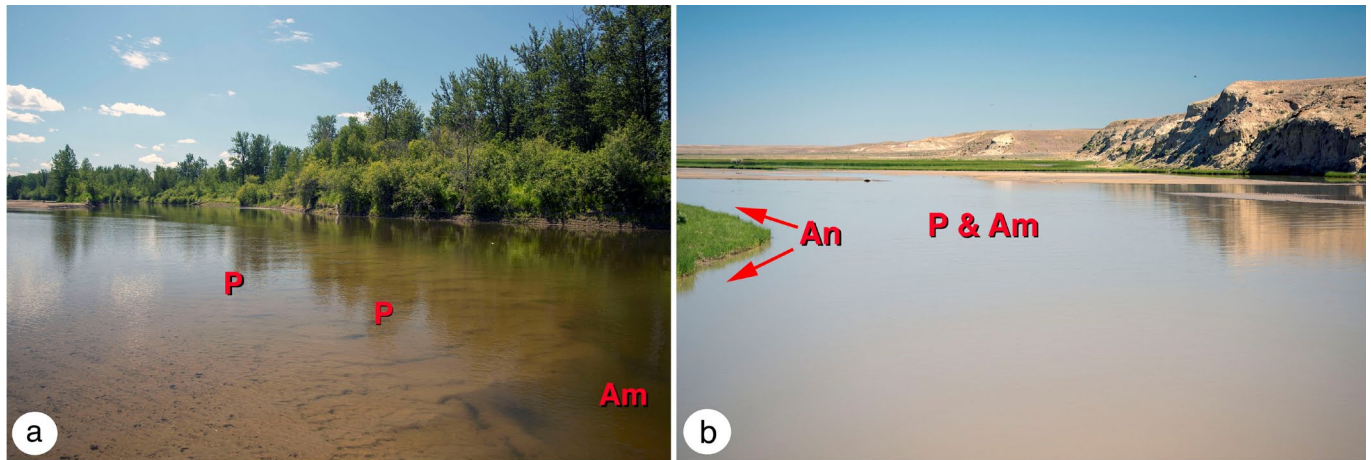


Figure 2. Habitat for psammophilic mayflies: a, Pembina River, Alberta; b, Milk River, Montana. Abbreviations: Am, *Ametropus*; An, *Anaetris*; P, *Pseudiron*.

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### **Pseudironidae: *Pseudiron* McDunnough** (Fig. 3).

One mayfly of particular interest was *Pseudiron centralis* McDunnough, the monotypic exemplar of the family Pseudironidae, and widespread in and endemic to North America. *Pseudiron* is often called the “crabwalker” mayfly because nymphs can scurry quickly across the sand in any direction, reminiscent of the movement of a crab. Their saltatory agility, and the fact that most psammophilic nymphs are excellent swimmers, can make their capture a challenge. *Pseudiron* has also garnered attention because of their predatory feeding habits. Soluk & Craig (1990) demonstrated that nymphs actually use their body position to generate an upstream vortex in front of the head. As the nymph moves upstream and forward, the vortex continually digs a pit in front of the head, exposing midge larvae and other potential prey buried in the sand.

My search for *Pseudiron* and other psammophilic mayflies began in the Nebraska Sandhills but took me as far afield as northwestern Colorado, northcentral Montana and southern Alberta. My first collections and photographs were from the North Loup River in north-central Nebraska, and Little Snake River in northwestern Colorado. It was at these sites where I discovered the most effective technique for capturing these elusive creatures usually involved simultaneously kicking sand, “dancing” backwards (i.e., stumbling) upstream, and flailing a D-net behind me [All of which was quite amusing to any on-lookers!]. After a couple western trips and (perhaps more importantly) perfecting HOW to collect them and WHEN to look, I unexpectedly found *Pseudiron* in many Iowa rivers. Ironically, one of the most productive Iowa sites was just a 5-minute walk from my house! Over the past few years of psammophile hunting, *Pseudiron* has proved to be one of the most widespread and frequently encountered psammophilic mayflies, with my records including approximately 20 locations across five states (Colorado, Iowa, Montana, Nebraska and Wisconsin), one province (Alberta), and numerous collection dates.

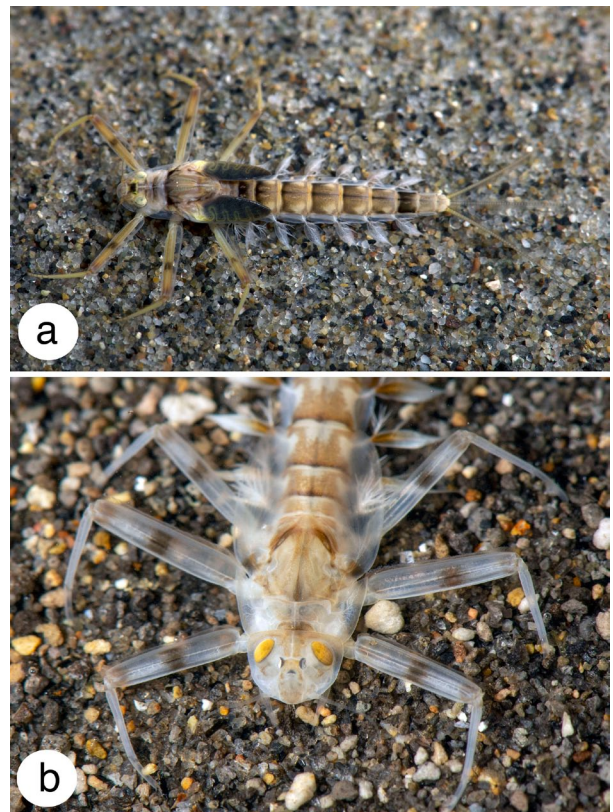


Figure 3. Psammophilic mayflies: *Pseudiron centralis* (Pseudironidae). a, habitus of mature nymph, Milk River, Alberta; b, anterior view of nymph, South Skunk River, Iowa.

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**Ametropodidae: *Ametropus Albarda*** (Fig. 4).

Another psammophile target was the mayfly Ametropodidae, commonly called "sand minnows". This Holarctic family contains a single genus, *Ametropus*, and two species (see Mayfly Central, <https://www.entm.purdue.edu/mayfly/na-species-list.php>), both of which occur in North America: *A. ammophilus* Allen & Edmunds in the Pacific Northwest and *A. fragilis* Albarda (including the former *A. albrighti* Traver & *A. neavei* McDunnough) in the intermountain west (including Alberta & Saskatchewan). *Ametropus* nymphs have also been the subject of behavioural studies, although they do something slightly different than *Pseudiron*. Soluk & Craig (1988) found that *Ametropus* nymphs remain in one location, buried in the sand, usually with the head and forelegs exposed. They then lift the forelegs into the current (see Fig. 4b), which generates a pair of vortices that again create a pit in front of the head. Food particles... in this case detritus... become entrapped in the vortices and are delivered to the pit (and the nymph's mouthparts). I was fortunate in having collected and photographed both North American species of *Ametropus*. My first encounter was *A. fragilis* at the Milk River in southern Alberta. I would subsequently find and photograph this species at other sites in southern Alberta, north-central Montana, and northwestern Colorado, as well as *A. ammophilus* at several sites in western and south-central Oregon.

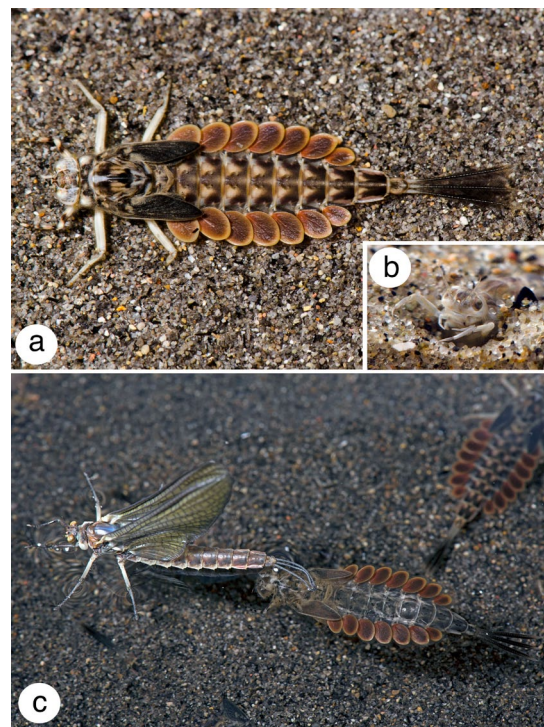


Figure 4. Psammophilic mayflies: *Ametropus* (Ametropodidae). a, habitus of mature *A. ammophilus* nymph, Wood River, Oregon; b, anterior view of partially buried *A. fragilis* nymph, Milk River, Alberta; c, emerging *A. ammophilus*, Wood River, Oregon.

**Oligoneuriidae: *Homoeoneuria* Eaton** (Fig. 5).

A third group on my wish list was *Homoeoneuria* Eaton, one of two oligoneuriid genera in North America (the other being *Lachlania* (Navas), which is not particularly psammophilic). *Homoeoneuria* contains seven species, including five in North America; however, only two occur in central- and western North America: *H. alleni* Pescador & Peters and *H. ammophila* (Spieth). These mayflies would prove to be another widespread and frequently encountered psammophile. My records include *H. alleni* from more than 10 locations across four states (Montana, Nebraska, South Dakota, and Utah) and *H. ammophila* from several locations in Iowa. Most records include multiple dates and often remarkable abundances. Like all other psammophilic mayflies, *Homoeoneuria* exhibits unusual nymphal behaviour. However, these nymphs are different in that they burrow into the sand first with the thorax, often leaving only the head and caudal filaments exposed on the surface (Fig. 5). Although hydrodynamic studies of their behaviour have not been done, *Homoeoneuria* probably does something similar to *Ametropus*. As an added benefit, any vortex in front of a *Homoeoneuria* nymph will presumably enhance delivery of oxygen across the gills, most of which are beneath the thorax.

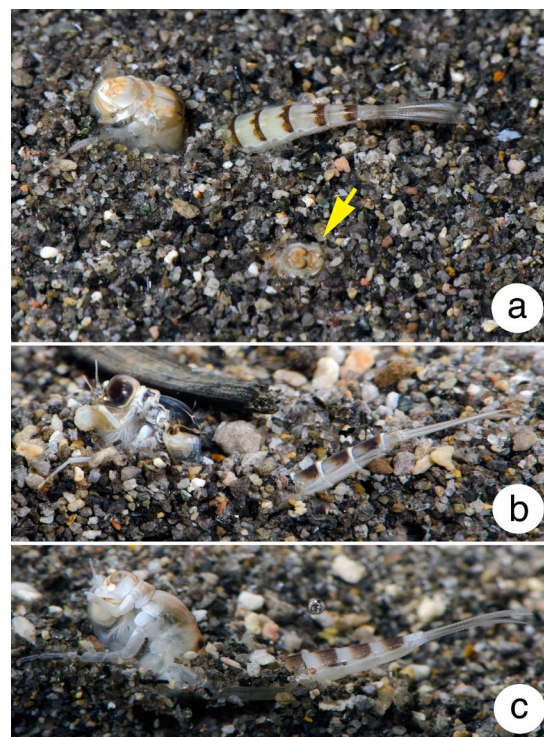


Figure 5. Psammophilic mayflies: *Homoeoneuria* (Oligoneuriidae). a, partially or mostly (see arrow = top of head and eyes) buried *H. ammophila* nymphs, Raccoon River, Iowa; b, partially buried male nymph of *H. alleni*, Niobrara River, Nebraska; c, partially buried female nymph of *H. alleni*, Niobrara River, Nebraska.

**Acanthametropodidae: *Analettris* Edmunds** (Fig. 6).

Perhaps the greatest challenge in my search for psammophilic mayflies was the family Acanthametropodidae, which contains two genera, the Holarctic *Acanthametropus* Tshernova and the monotypic North American endemic *Analettris eximia* Edmunds. The Nearctic exemplar of *Acanthametropus*, *A. peconica* Burks, is considered by many experts as the rarest mayfly in North America. Although recorded from the upper Midwest (northern Illinois and southwestern Wisconsin) and southeastern United States (Georgia & South Carolina), this mayfly has never been collected in abundance. This has been attributed in part to their preference for large, deep rivers, their reputation as rapid swimmers, and recent habitat degradation, at least in the upper Midwest (McCafferty 1991). Although I have searched for *Acanthametropus* at known sites in Wisconsin and seemingly suitable sites in the southeastern US, my searches have garnered only wet clothes and exhausted arms (both because of the depth of sampling efforts). Thankfully, my search for the western acanthametropodid genus, *Analettris*, has been more successful (but still usually resulting in wet clothes and tired arms!).

My first encounter with *Analettris eximia* Edmunds was somewhat unexpected. I had stopped along the Red Deer River in southern Alberta, partly because Lehmkuhl (1976) had recorded large numbers of *Analettris* downstream, in the South Saskatchewan River (across the border, in Saskatchewan). Any optimism at finding *Analettris* on that day was dashed when I noticed the river was high & turbid. Despite this, I found a sandy area where I could wade in and sweep for mayflies. My efforts yielded only a singleton *Ametropus*. Clothes already soaked, I worked my way upstream along the bank, even though I couldn't see the bottom and the water was waist deep and relatively swift. After an off-balance sweep along the margin yielded a single *Analettris*, I shifted to standing in the river a meter or so from the bank, facing the bank, and sweeping my net vigorously against the bank (where the slope seemed quite steep). After adopting this technique, I was able to capture several *Analettris* nymphs as I progressed upstream (I can also confirm that these nymphs are indeed agile and rapid swimmers!). I subsequently used the same method with success at another site on the Red Deer River, as well as on the Milk River in north-central Montana (Fig. 2b), where I collected *Analettris* on several occasions.

**Behningiidae: *Dolania* Edmunds & Traver** (Fig. 7).

No discussion of psammophilic mayflies is complete without mention of the Behningiidae, which includes perhaps the most specialized sand-inhabiting nymphs. The adults and life history of these mayflies are comparably bizarre (Peters & Peters, 1984). The family contains three genera (Hubbard 1994), the Palaearctic and Oriental genera *Behningia* Lestage (3 species) and *Protobehningia* Tschernova & Bajkova (2 species), and the monotypic North American *Dolania americana* Edmunds & Traver. *Dolania* is known primarily from the southeastern United States (except for two 1989 nymphal records from Wisconsin). My collections and photographs of this mayfly are from the Blackwater River in the Florida panhandle (Fig. 1c). *Dolania* is another group in which the hydrodynamics of their nymphal behaviour has not been studied. However, these nymphs do something totally different than other nymphs mentioned above... the nymph burrows beneath the surface of the sand, where it searches for chironomid larvae and other prey. Their mouthparts, legs, and many other anatomical structures are unusual for a mayfly nymph and presumably adaptations to their predatory habits and "subsurface" activities (Tsu & Hubbard 1979). The latter presents a challenge to collecting these nymphs. Unlike other psammophilic groups, which are usually on the surface or buried only a few millimeters beneath it, *Dolania* nymphs can be several centimeters beneath the surface. My own collections have typically included scooping sand from the bottom, then waiting for the sand particles to pass through the mesh of my D-net.

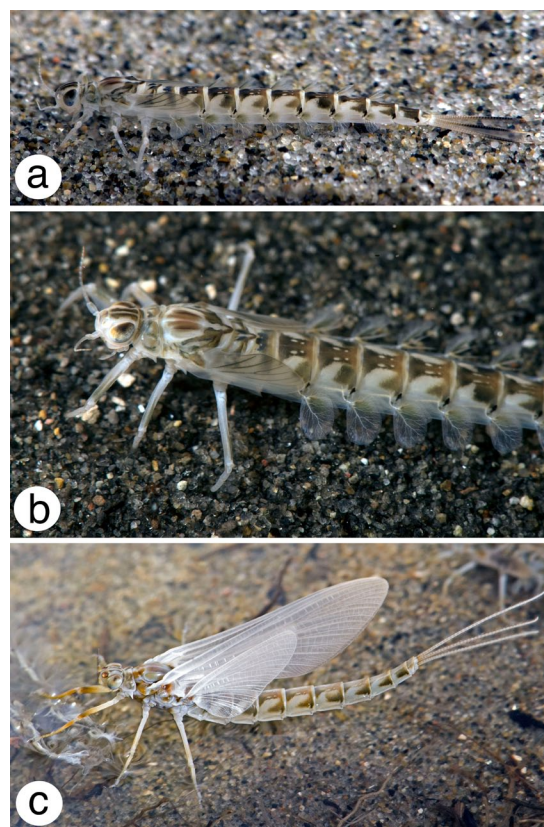


Figure 6. Psammophilic mayflies: *Analettris eximia* (Acanthametropodidae). a, habitus of mature nymph, Red Deer River, Alberta; b, anterior view of mature nymph, Milk River, Montana; c, recently emerged subimago, Milk River, Montana.

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Figure 7. Psammophilic mayflies: *Dolania americana* (Behningiidae). a, habitus of "swimming" nymph, Blackwater River, Florida; b, habitus of burrowing nymph, Blackwater River, Florida.

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### Sympatry, phenology & microhabitat.

It is perhaps expected that multiple psammophilic mayfly species can be sympatric in rivers of central and western North America. Many if not most midwestern rivers (i.e., those with suitable shifting-sand habitats) harbor populations of both *Pseudiron* and *Homoeoneuria*. In these instances, phenological separation is typical, with *Pseudiron* active primarily during early to mid-summer, at which time small *Homoeoneuria* nymphs may start to appear. The latter nymphs can be quite common in late summer and early fall. This pattern was most striking in rivers of the Nebraska Sandhills (e.g., lower Niobrara River, various forks of the Loup River). Levels of sympatry were even greater in some western rivers (e.g., Red Deer River and Milk River), where *Pseudiron*, *Ametropus* and *Analetris* were sometimes present along the same general reach of river. However, unlike in the Midwest, there appeared to be less seasonal separation of populations. Instead, microhabitat partitioning was suggested. Throughout their range, *Pseudiron* and *Homoeoneuria* nymphs seemed most abundant in the "active" portions of sand shoals, usually where sand ripples were abundant. In contrast, *Ametropus* nymphs were often most abundant along the margins or downstream edges of sand shoals, usually where water depth was increasing. Likewise, *Analetris* nymphs were encountered most often on the margins of deeper, mid-stream channels or on steep drop-offs along the shoreline.

### Concluding remarks.

Despite a few new records and a bit more anecdotal information, we remain sorely ignorant about the distribution and biology of these psammophilic mayflies. Specific insights on nymphal microhabitat and habits, phenologies, and other biological characteristics are lacking for most populations. This is exacerbated by the difficulty in sampling psammophilous habitats, particularly in large, deep rivers. The future use of novel collecting techniques (e.g., Lillie 1995) may be critical to effectively documenting the fauna of such habitats. Furthermore, it is unclear how environmental changes (e.g., increasing temperature and decreasing precipitation) will impact local populations of psammophilic insects. Needless to say, drought could easily diminish or eliminate shifting-sand habitats at a critical time in an insect's life history, thereby leading to extirpation of local populations. In fact, this could explain the apparent lack of *Ametropus* in the Little Snake River in northwestern Colorado. Historical records suggest that this river may have been one of the better *Ametropus* sites in Colorado, yet several visits since 2013 have yielded no specimens. After seeing the river almost completely dry in late summer, 2013 (Fig. 8b), I wonder if the absence of *Ametropus* is because droughts occurred at a time when nymphs would normally undergo substantial growth. The latter could obviously be a challenge if the habitat is gone! It follows that these insects may be sensitive indicators of changing temperatures and precipitation, especially in western rivers.

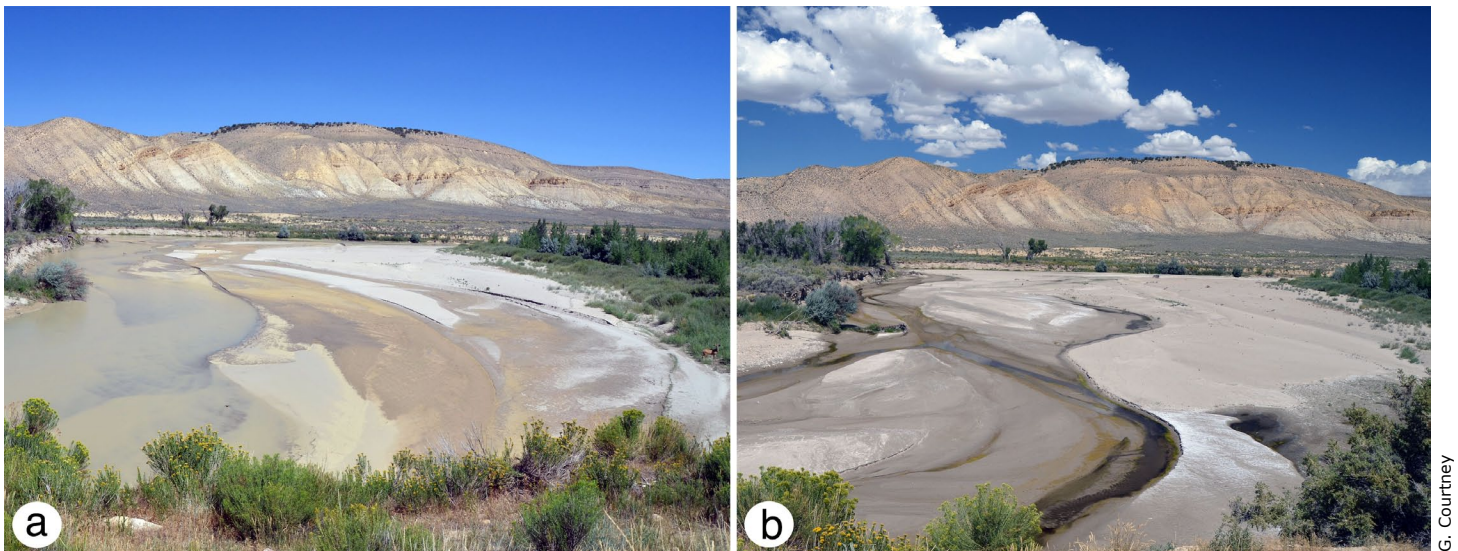


Figure 8. Little Snake River, Colorado: a, August 2014 (normal flow?); b, August 2013 (drought year).

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## New Program Notice: IISD Experimental Lakes Area's Artist-in-Residence program (Ontario, Canada)

**IISD Experimental Lakes Area (IISD-ELA), the world's freshwater laboratory, is very proud to announce its Artist-in Residence program.**

### What is IISD Experimental Lakes Area?

Put simply, IISD-ELA is an artist's dream. It is a series of 58 pristine lakes, set within Canada's boreal forest in northwestern Ontario, set aside for a unique approach to scientific research.

Photos reveal a space of great peace and tranquility, vast expanses of untouched lakes bordered by dense forests, and a busy community of scientists working together towards common goals. Being there and experiencing it for yourself reveals so much more.

### What is IISD-ELA's Artist-in-Residence program?

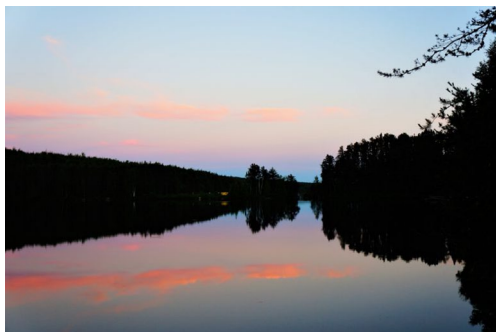
Are you a painter? Or photographer? Writer, poet, songwriter? If you create any kind of expressive art, we are interested in inviting you to the site to spend at least one week here from May to October. The dates are negotiable, and travel to and from the site, accommodation and food is included.

You will meet the residents (there are usually about 20-50 people at the site at any given time), go out on the lakes, take part in the science, get your hands dirty and experience the solitude and excitement of the world's freshwater laboratory for yourself.

**The Deadline for 2019 is Jan. 10, but the program is expected to be repeated next year.**

For more information, and to apply, visit

<https://www.iisd.org/ela/blog/news/iisd-elas-artist-residence-program/>





## How to Donate to the International Permanent Committee on Ephemeroptera Scholarship Fund

This fund (Canadian Tax Reg. No. BN 88915 1379 RR001) provides travel scholarships to assist upcoming scientists to attend our international conferences. You have several options to donate to the mayfly travel fund. The committee can accept a cheque, a wire transfer or you can use our PayPal account. More details are provided below.

- 1) Cheque.** Please make cheque payable to: "International Permanent Committee on Ephemeroptera" and mail to Alexa at the address below.
- 2) Wire transfer.** Wire transfer. By arrangement with the treasurer. Please email [alexa@ecobmi.com](mailto:alexa@ecobmi.com)
- 3) PayPal.** Business account: International Permanent Committee for Ephemeroptera Scholarship Fund, Merchant account #: X5YQ83HA2AFML Email: [alexa@ecobmi.com](mailto:alexa@ecobmi.com).

Do let me know how I can help if any of this information is unclear.

### Alexa C. Alexander Trusiak,

Permanent Committee Treasurer

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## 2016/17 Ephemeroptera Bibliography Update

Additions to the 2016 / 2017 Ephemeroptera Biology. Please report corrections and additions to Donna Giberson, Editor of the *Mayfly Newsletter*, so an update can be published in the next Newsletter.

- Aydinli C. 2017. Contribution to the Knowledge of Ephemeroptera (Insecta) of the Eastern Black Sea Region. *Journal of Entomological Research Society*, 19(3): 95-107. WOS:000418780600011
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- Koch S. 2016. Die Eintagsfliegen Bayerns: Aktueller Verbreitungsatlas, Bestandssituation und Bestandstrend (Insecta, Ephemeroptera) - The Mayflies of Bavaria: Current Distribution Atlas, Population Status and Population Trend. *Mitteilungen der Münchner entomologischen Gesellschaft* 106: 65-127.
- Macadam CR and Stockan JA 2017. The diversity of aquatic insects used as human food. *Journal of Insects as Food and Feed* 3(3): 203-209.

### Need PDFs for Ephemeroptera Galactica

Two questions:

**Have you published a paper on mayflies?**

**If so, did you send a PDF to EG?**

Ephemeroptera Galactica (EG) is a web site that was developed by Mike Hubbard and is now maintained by Arnold Staniczek. One of the great features of EG is the bibliography of mayfly literature at this site. PDFs of hundreds of mayfly articles are available. To keep this bibliography updated, please send a PDF of your articles on mayflies to Arnold ([arnold.staniczek@smns-bw.de](mailto:arnold.staniczek@smns-bw.de)).

## In Memorium

**Tomáš Soldán**, a well known personality in the community of mayfly researchers, passed away after a short illness at the age of 66 on Monday August 13, 2018.

Tomáš was interested in entomology since his childhood and his professional life was closely connected with the Institute of Entomology of the Czech Academy of Sciences, where he worked for more than 40 years.

He was a widely renowned expert on the taxonomy and morphology of mayflies, although he contributed to research in several other fields of entomology (study of insect reproduction, gonad ontogeny, or various faunistic or ecological projects involving taxocenes of aquatic insects).

During his career, Tomáš wrote almost 300 scientific studies and described more than 70 mayfly species. For his contribution to the knowledge of mayflies, he was awarded with the *Lifetime Achievement Award*, awarded on the occasion of international conferences on mayflies and stoneflies. He thus entered the company of the greatest personalities in the history of his field. The high level of respect with which he was regarded by his colleagues is also demonstrated by the fact that nine mayfly species have been named in his honor and bear the patronymic name *soldani*.

Above all his activities, Tomáš was an enthusiastic insect collector; he loved expeditions and traveled through many countries on every continent of the world, driving thousands of kilometers when collecting mayflies. During field trips, Tomáš was a pleasant and entertaining companion. In the last years of his life, it was the collecting in poorly studied regions that brought him the greatest joy from his work.

He cooperated with a number of Czech and foreign colleagues. With many of them, he maintained very cordial relationships. He will be missed by many.



**Tomáš Soldán  
1951-2018**



## We're looking for submissions to the *Mayfly Newsletter*!

Do you have anything you'd like to share with your fellow ephemeropterists? In addition to the Notices, Mayfly Bibliography, and information about the upcoming International Meeting, we'd like to include project updates, book reviews, notices of upcoming meetings of interest to Ephemeroptera workers, requests for collaboration, and any interesting notes about mayflies.

So - my questions to you - Are you looking for collaborators on a project? Do you have some spectacular mayfly photos that you'd like to share with your colleagues? Is there a special collecting site or new collecting method whose details would be of interest to other mayfly workers? Have you ever had an adventure in collecting mayflies? We publish our data in our research papers, but sometimes the story behind the story is equally interesting!

**Deadlines:**

- Summer issue: May 15

- Winter issue: Dec. 1

## The *Mayfly Newsletter*

Starting with the Winter 2016 issue, the Mayfly Newsletter has gone digital! You will be able to find the link to the issues on the Digital Commons site: <https://dc.swosu.edu/mayfly/> (or see link on *Ephemeroptera Galactica* (<http://www.ephemeroptera-galactica.com>)). If you haven't already passed your email address to Peter Grant, remember to contact Donna ([giberson@upei.ca](mailto:giberson@upei.ca)) with your email address if you would like to receive notification when new issues are posted. Unfortunately, due to costs of printing and postage, we won't be able to send a printed newsletter out by post.

**However, original copies of many of the printed issues are still available Contact Peter Grant if you would like a set and he can arrange to send them to you: [peter.grant@swosu.edu](mailto:peter.grant@swosu.edu)**

**The *Mayfly Newsletter*** is the official newsletter of the Permanent Committee of the International Conferences on Ephemeroptera and is published to facilitate communication among ephemeropterists.

Subscriptions to the Newsletter are free. To place your name on the e-mailing list or to contribute information for the next issue, contact:

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