Chlupach, R. S. 1975. Studies of Introduced Blackfish in Waters of Southcentral Alaska. Annual Performance Report for Sport Fish Studies, Volume 16, Study G-II, Alaska Department of Fish and Game. URL http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDF-9-7(16)G-II-K.pdf.

Eidam, D. M., F. A. von Hippel, M. L. Carlson, D. R. Lassuy, and J. A. López. 2016. Trophic ecology of introduced populations of Alaska blackfish (*Dallia pectoralis*) in the Cook Inlet Basin, Alaska. Environmental Biology of Fishes **99**:557–569. doi:10.1007/s10641-016-0497-6.

Gudkov, P. K. 1998. Bering Sea *Dallia pectoralis* in the Chukchi Peninsula. Journal of Ichthyology **38**:199–203.

Mecklenburg, C. W., T. A. Mecklenburg, and L. K. Thorsteinson. 2002. Fishes of Alaska. American Fisheries Society, Bethesda, Maryland.

Ostdiek, J. L., and R. M. Nardone. 1959. Studies on the Alaskan blackfish *Dallia pectoralis* I. Habitat, size and stomach analyses. The American Midland Naturalist **61**:218–229. URL http://www.jstor.org/stable/2422353.

Stratton, B., and P. Cyr. 1997. Annual Management Report for the Anchorage Area, 1995. Fishery Management Report 97-1, Alaska Department of Fish and Game. URL http://www.sf.adfg.state.ak.us/fedaidpdfs/Fmr97-01.pdf.

Two new records of mayflies (Ephemeroptera) from Alaska

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by Matt Bowser[1]

Sikes et al. (2017) noted that DNA barcode sequences from mayflies (Ephemeroptera) were poorly represented from Alaska. While opportunistically collecting and submitting mayflies for DNA barcoding, we at the Kenai National Wildlife Refuge found that two specimens we collected appear to be new records for Alaska.

Ameletus celer McDunnough, 1934

A single naiad (KNWR:Ento:11230, MOBIL5127-17) was collected from Johnson Creek, northern Kenai Peninsula, at the bridge where the Gull Rock Trail crosses the creek on June 8, 2017. The specimen was collected directly into a lifescanner (http://lifescanner.net/) vial in the field and identified only by DNA barcoding as *Ameletus celer* McDunnough, 1934. The sequence from this specimen was grouped by BOLD's BIN algorithm (Ratnasingham and Hebert, 2013) into BIN BOLD:AAE5588 in which 89 sequences are identified as *A. celer* and one sequence is identified as *Ameletus*.

Ameletus celer was not listed from Alaska by Randolph and McCafferty (2005), but this species is widespread in northwestern North America (Zloty, 1996), including near the Alaska border in the Yukon (GBIF.org, 2019*a*).

Paraleptophlebia strandii (Eaton, 1901)

A subimago or adult specimen (KNWR:Ento:11298, MOBIL8445-18) was collected from the surface of Daniels Lake in Nikiski on the Kenai Peninsula on August 2, 2018. The specimen was identified as *Paraleptophlebia strandii* (Eaton, 1901) by its DNA barcode. The sequence from this specimen was grouped by BOLD's BIN algorithm into BIN BOLD:AAU2089 in which all 12 member sequences were identified as *P. strandii*.

Paraleptophlebia strandii was not listed from Alaska by Randolph and McCafferty (2005) and appears to be unreported from North America in the literature. However, a private record on BOLD from the Yukon is a 100% match (*p*-dist) with the sequence from Nikiski and is also identified as *P. strandii*. The previously known range of this species includes Fennoscandia to the Russian Far East (Salmela and Savolainen, 2013; GBIF.org, 2019*b*).

References

GBIF.org. 2019*a*. GBIF Occurrence Download. doi:10.15468/dl.dage7t.

GBIF.org. 2019*b*. GBIF Occurrence Download. doi:10.15468/dl.yvajuv.

Randolph, R. P., and W. P. McCafferty. 2005. The mayflies (Ephemeroptera) of Alaska, including a new species of Heptageniidae. Proceedings of the Entomological Society of Washington **107**:190–199. URL https://www.biodiversitylibrary.org/part/40762.

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Ratnasingham, S., and P. D. N. Hebert. 2013. A DNA-based registry for all animal species: The Barcode Index Number (BIN) system. PLoS ONE **8**:e66213. doi:10.1371/journal.pone.0066213.

Salmela, J., and E. Savolainen. 2013. New records of *Paraleptophlebia werneri* Ulmer, 1920 and *P. strandii* (Eaton, 1901) from Finland (Ephemeroptera, Leptophlebiidae). Biodiversity Data Journal **1**:e969. doi:10.3897/BDJ.1.e969.

Sikes, D. S., M. Bowser, J. M. Morton, C. Bickford, S. Meierotto, and K. Hildebrandt. 2017. Building a DNA barcode library of Alaska's nonmarine arthropods. Genome **60**:248–259. doi:10.1139/gen-2015-0203.

Zloty, J. 1996. A revision of the Nearctic *Ameletus* mayflies based on adult males, with descriptions of seven new species (Ephemeroptera: Ameletidae). The Canadian Entomologist **128**:293–346. doi:10.4039/Ent128293-2.

Changes in soil fungal communities in response to invasion by *Lumbricus terrestris* Linnaeus, 1758 at Stormy Lake, Nikiski, Alaska

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by Matt Bowser[1]

Introduction

It is now well established that European earthworms (Lumbricidae) introduced to forests of North America reduce or remove preexisting leaf litter and organic layers (Bohlen et al., 2004; Hale et al., 2005; Suárez et al., 2006), altering nutrient cycles and the soil carbon balance (Bohlen et al., 2004; Hale et al., 2005; Resner et al., 2015). Exotic earthworms can also reduce the abundance of soil fungi in general (Dempsey et al., 2011) and affect mycorrhizal fungi in particular (McLean et al., 2006; Szlávecz et al., 2011), thereby impacting plants that depend on mycorrhizal relationships (Lawrence et al., 2003).

Although the consequences of exotic earthworm invasion have been demonstrated in formerly glaciated regions of North America (see Frelich et al., 2006, for a review), less is known about how earthworms might change Alaskan forests, where the climate is colder than most other locations where invasive earthworm effects have been studied. Alaskan forests are also generally at a much earlier stage of invasion than other formerly glaciated regions where earthworm populations are now well established, offering opportunities to learn more about incipient invasions.

Invasive lumbricid earthworm species can be grouped into three functional types based on their feeding and burrowing habits (Bouché, 1977). Epigeic species live at the soil surface, feeding on leaf litter. Endogeic species borrow horizontally belowground in mineral soil. Anecic earthworms excavate vertical burrows. Of these functional types, anecic species alter previously earthworm-free soils more than others (Frelich et al., 2006). By foraging on organic litter at the ground surface, feeding in vertical borrows, and depositing casts that form new mineral topsoil, anecic worms consume upper organic soil layers and vertically homogenize the soil profile through their burrowing and mixing.

In Southcentral Alaska the only anecic species known to be established is *Lumbricus terrestris* Linnaeus, 1758; other anecic species including *Aporrectodea longa* (Ude, 1895) and *Lumbricus friendi* Cognetti, 1904 have not been documented in this region. Outside of developed areas, *L. terrestris* has been found at boat launches in this region, likely introduced via "bait abandonment" (Saltmarsh et al., 2016).

Lumbricus terrestris was first documented at Stormy Lake, Nikiski Alaska in 2012 at a public boat launch (Eskelin and Bowser, 2012). Later it was observed that *L. terrestris* had already removed the leaf litter layer at this locality, exposing tree roots (Bowser, 2016*a*,*d*). Other soil-dwelling oligochaetes known to be present in this area were the exotic, epigeic earthworm *Dendrobaena octaedra* (Savigny, 1826) (Bowser, 2016*d*), which is almost ubiquitous near roads on the Kenai Peninsula (Saltmarsh et al., 2016); the native, epigeic earthworm *Bimastos rubidus* (Savigny, 1826) (Bowser, 2016*b*), and enchytraeids including *Fridericia ratzeli* (Eisen, 1872) (Bowser, 2016*c*).

In this small pilot study I sought to learn how invasion by *L. terrestris* might change the composition of soil fungal communities—especially mycorrhizal fungi—in Southcentral Alaskan forests where it has been introduced and subsequently established.

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