Using the CO1 gene and DNA barcoding to identify caddisflies (Trichoptera)

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Abstract

Through the help of DNA identifier mitochondrial gene cytochrome oxidase subunit 1 (CO1) and DNA barcoding we were able to identify different genera and species of Caddisflies. Most types of caddisflies are pollution sensitive. Caddisfly larvae are widely used to measure water quality. Samples were collected from Johnson Creek, where we identified the samples, extracted DNA, and amplified the DNA using PCR. Next, we used gel electrophoresis and PCR cleanup. We sent the DNA to Wayne State University for sequencing, which allowed us to view the sequence alignments and identify their species through building a phylogenetic tree. Four different species were collected from the Johnson Creek site in 2013 and 2015: *Hydropsyche betteni*, *Cheumatopsyche analis*, *Cheumatopsyche oxa*, and *Cheumatopsyche wrighti*. These results indicate that we found two different genera of caddisflies (*Hydropsyche* and *Cheumatopsyche*).

Johnson Creek

Hydropsyche betteni

Introduction

Caddisflies are macroinvertebrates that are from the order Trichoptera. Netspinners are in the family Hydropsychidae. Caddisfly larvae live in aquatic environments and are good water quality indicators that are easy to sample and identify. Through DNA barcoding we are able to identify the samples we collected determine whether the water quality is fair.

Methods

- Gathered and identified specimens from Johnson Creek
- Extracted the DNA
- Amplified DNA using PCR amplification, gel electrophoresis, and PCR cleanup
- Used sequence alignment to identify genera and species of caddisflies
- Built a phylogenetic tree using information from GenBank and sequence alignment
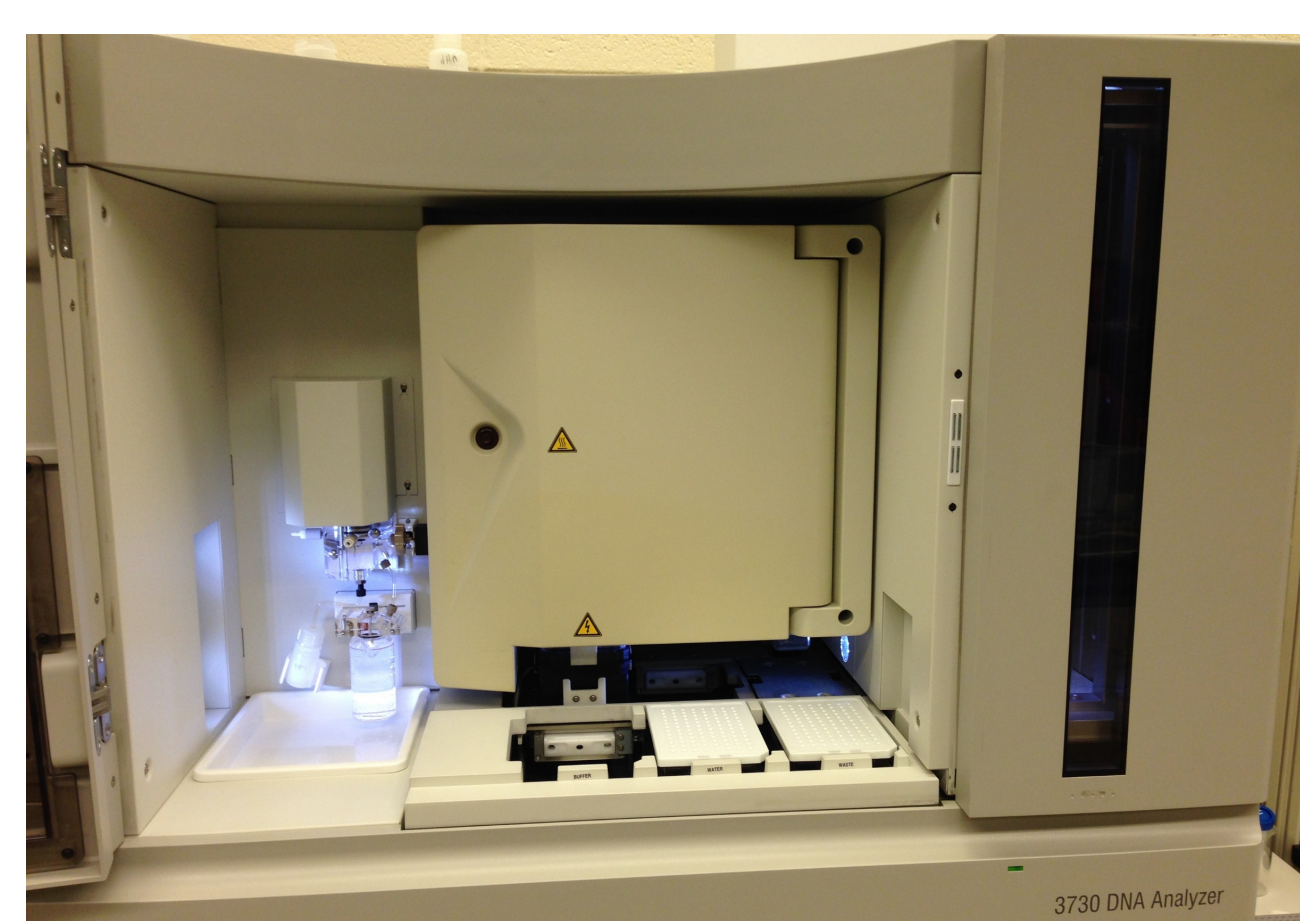
Gathering insect samples

Gel electrophoresis

DNA fragment

sample ladder
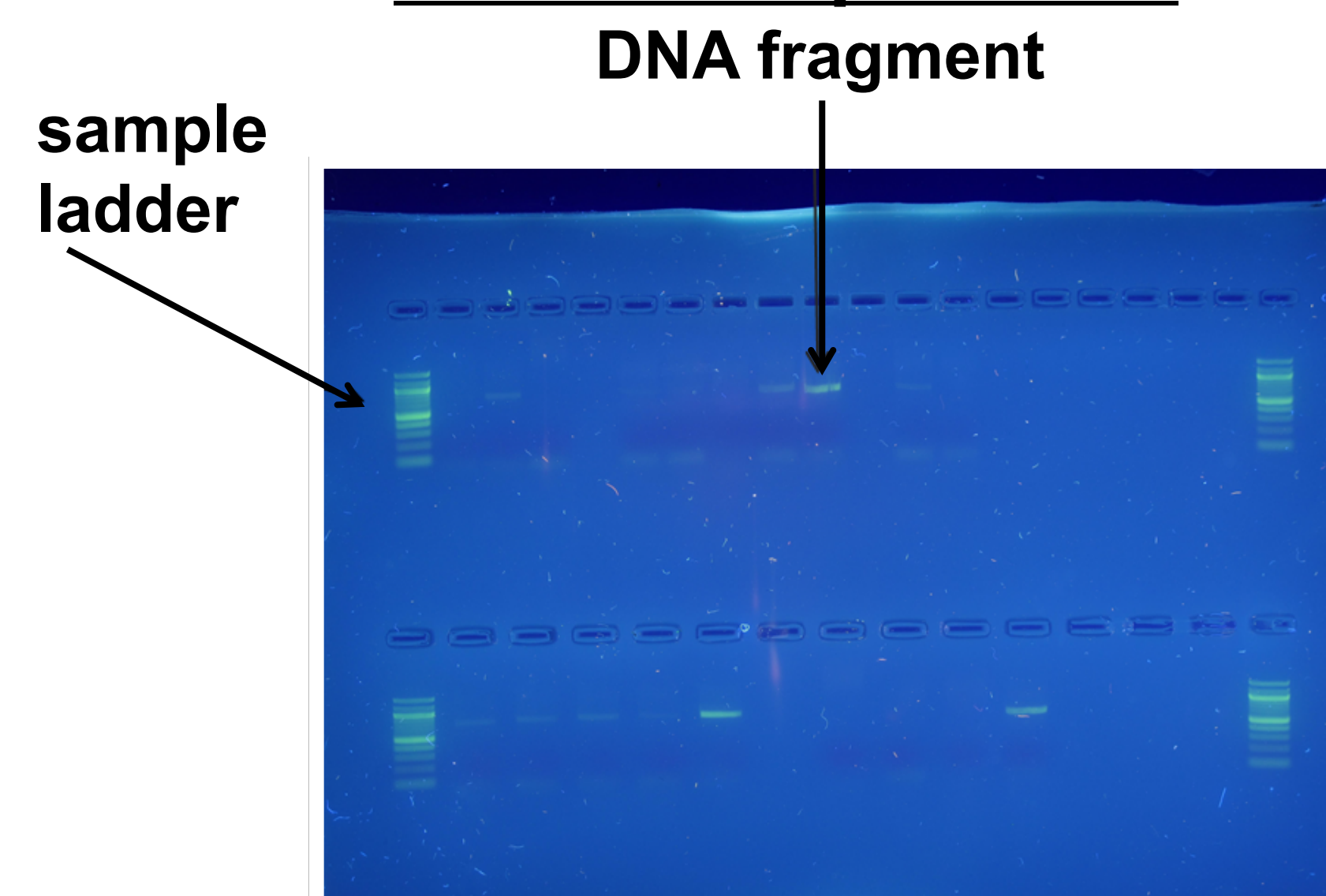
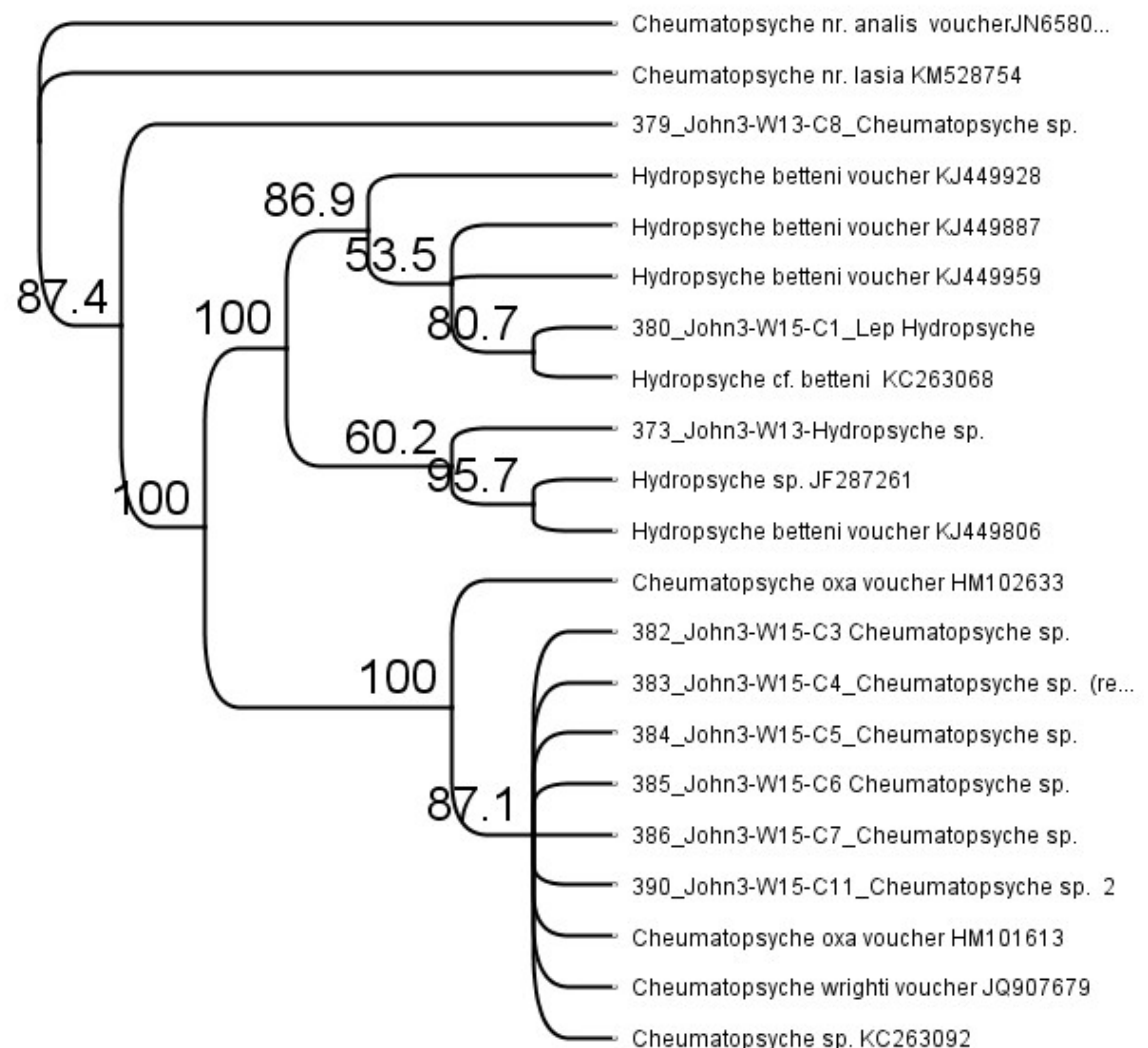### Using Geneious for DNA sequence alignment

DNA sequencing at Wayne State University

Data and Results

- Two types of caddisflies, *Hydropsyche betteni* and *Cheumatopsyche analis,* were collected from the John 3 site from 2013 and 2015.

- 98.5% pairwise match with *Hydropsyche betteni* and 97.8% pairwise match with *Cheumatopsyche* sp.

- Our amplified DNA was sent to WSU for Sanger sequencing. The DNA sequences were analyzed using Geneious followed by BLAST, comparing our specimens to others in the DNA Barcode library.

- Our sequences showed high degree of similarity to the specimens in the DNA Barcode library.

This phylogenetic tree helps us to compare the samples that we gathered with specimens that they are closely related to.

Cheumatopsyche nr. analis voucherJN6580...
Cheumatopsyche nr. lasia KM528754
379_John3-W13-C8_Cheumatopsyche sp.
Hydropsyche betteni voucher KJ449928
Hydropsyche betteni voucher KJ449887
Hydropsyche betteni voucher KJ449959
380_John3-W15-C1_Lep Hydropsyche
Hydropsyche cf. betteni KC263068
373_John3-W13-Hydropsyche sp.
Hydropsyche sp. JF287261
Hydropsyche betteni voucher KJ449806
Cheumatopsyche oxa voucher HM102633
382_John3-W15-C3 Cheumatopsyche sp.
383_John3-W15-C4_Cheumatopsyche sp. (re...
384_John3-W15-C5_Cheumatopsyche sp.
385_John3-W15-C6 Cheumatopsyche sp.
386_John3-W15-C7_Cheumatopsyche sp.
390_John3-W15-C11_Cheumatopsyche sp. 2
Cheumatopsyche oxa voucher HM101613
Cheumatopsyche wrighti voucher JQ907679
Cheumatopsyche sp. KC263092

87.4 / 86.9 / 53.5 / 100 / 80.7 / 60.2 / 95.7 / 100 / 100 / 87.1

Discussion

Using the mitochondrial gene cytochrome c oxidase, we were able to use DNA barcoding to identify two genera of caddisflies (*Hydropsyche* and *Cheumatopsyche*) and four different species *(H. betteni, C. analis, C. oxa, C. wrighti)*. With this information we were able to construct a phylogenetic tree. These species were closely related and are all from the Hydropsychidae family.

Acknowledgements

References

- Hebert PDN, Cywinska A, Ball SL, deWaard JR. 2003. Biological identifications through DNA barcodes. Proc. R. Soc. Lond. B 270: 313-321.
- Fusaro, A. 2016. "Aquatic Ecosystems" Slides. BIO 151, Marygrove College, Detroit, MI.