

# Biomonitoring bugs by molecules: Slikok Creek

Matt Bowser<sup>a</sup>



3.Feb.2018

Eleventh annual meeting  
of the  
Alaska Entomological Society, Anchorage, Alaska

<sup>a</sup>U.S. Fish & Wildlife Service, Kenai National Wildlife Refuge



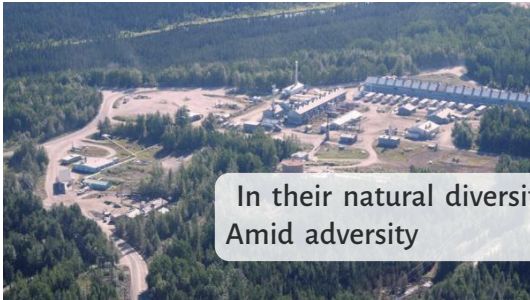
Said the folks on the Hill  
Keep that Great Land great still,

07/19/2015



The fish and the wildlife  
You must conserve

# Stressors: climate, development, exotic species



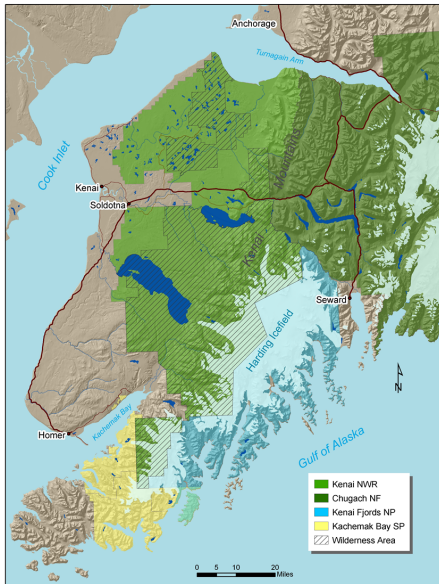
In their natural diversity  
Amid adversity





Every fish, bird and bug





On the Kenai reserve



*(instrumental — Kenai Refuge landscape photos)*



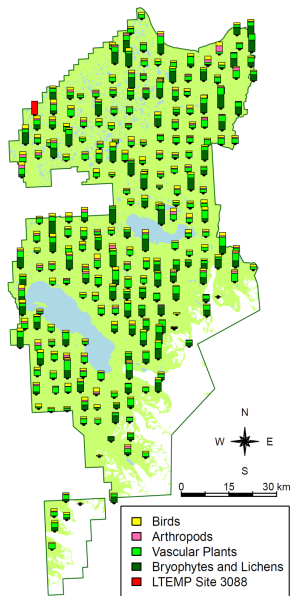


# Long Term Ecological Monitoring Program, $t_1$

**1,106 species documented**



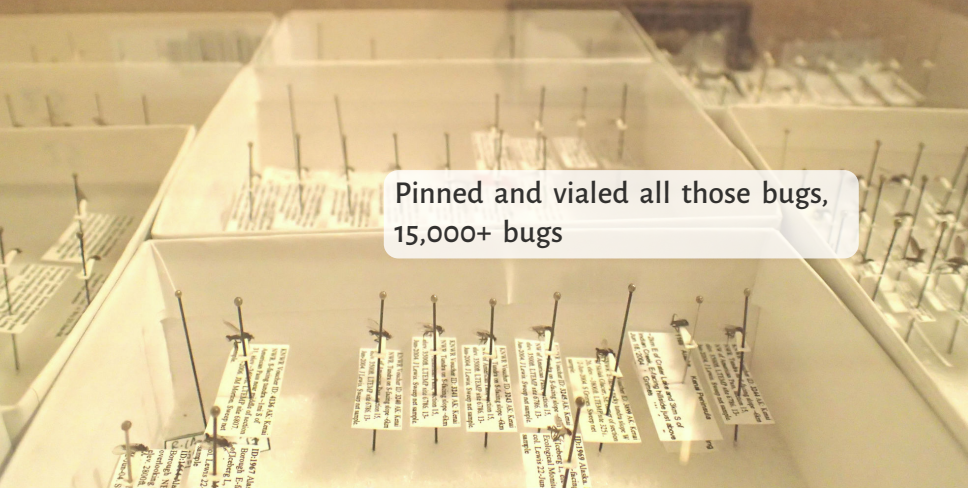
To enable monitoring  
Of communities





110-

Pinned and vialled all those bugs,  
15,000+ bugs



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TERRESTRIAL ARTHROPOD BIODIVERSITY  
ON THE KENAI NATIONAL WILDLIFE REFUGE, ALASKA

A  
THESIS

Presented to the Faculty  
of the University of Alaska Fairbanks  
in Partial Fulfillment of the Requirements  
for the Degree of

MASTER OF SCIENCE

By

Matthew L. Bowser

Fairbanks, Alaska

May 2009

**This guy did his best  
By morphology**



# Conventional workflow



But No, it won't work  
To monitor this way



D e S i t k a.

2 espèces de *Cychnus*.  
5 » de *Feronia*.  
1 » de *Patropus* nouv. *planusculus* N.  
1 . d'*Amara*, et 1 espèce de *Nebria*.

# Metabarcoding workflow

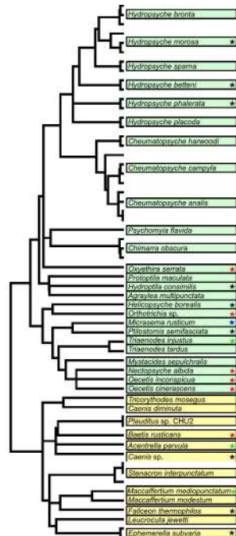


So we have been trying  
Metabarcoding:  
Mushed bugs...

# Metabarcoding



are sequenced  
And identified



# A small test: Kenai grasslands, 2015

- ▶ 10 sites
- ▶ One 100 m<sup>2</sup> sweep at each

We tried a small test  
With pretty good success



# Kenai grasslands 2015: results



Biodiversity Data Journal 5: e10792  
doi: [10.3897/BDJ.5.e10792](https://doi.org/10.3897/BDJ.5.e10792)



Research Article

## Arthropod and oligochaete assemblages from grasslands of the southern Kenai Peninsula, Alaska

Matthew L. Bowser<sup>‡</sup>, John M. Morton<sup>‡</sup>, John Delton Hanson<sup>§</sup>, Dawn R. Magness<sup>‡</sup>, Mallory Okuly<sup>‡</sup>

<sup>‡</sup> U.S. Fish & Wildlife Service, Kenai National Wildlife Refuge, Soldotna, Alaska, United States of America

<sup>§</sup> Research and Testing Laboratory, Lubbock, Texas, United States of America

Corresponding author:

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<https://doi.org/10.3897/BDJ.5.e10792>

### Abstract

### Background

By the end of this century, the potential climate-biome of the southern Kenai Peninsula is forecasted to change from transitional boreal forest to prairie and grasslands, a scenario

Photo: <http://boldsystems.org/pics/BBHCN/1obbchem-0256%2B1291048108.jpg>.

► 67 species



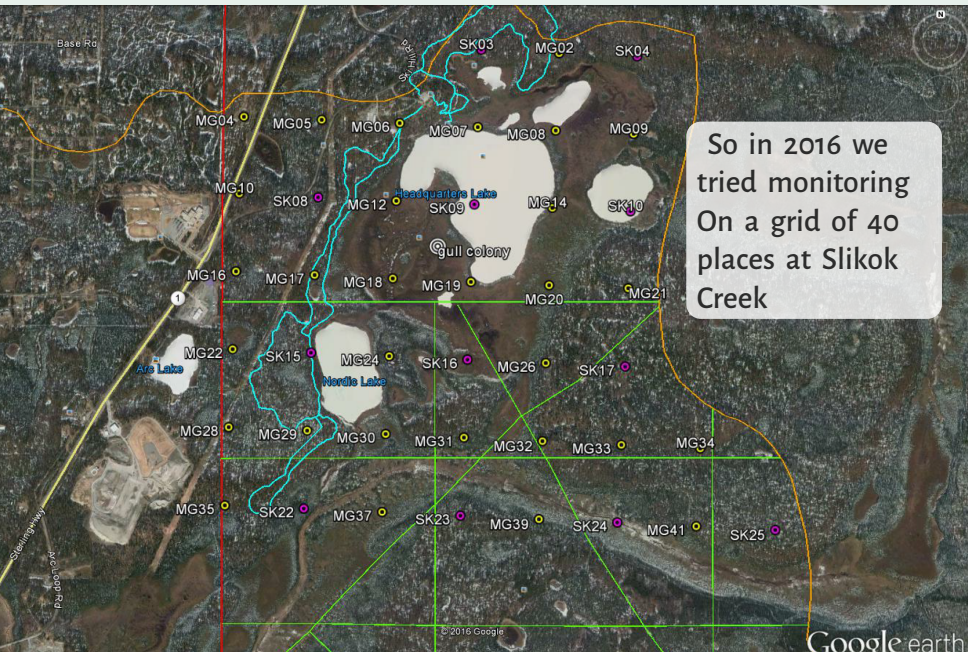
Identifying things  
From 10 samples we tried.





And it seemed a lot better  
To monitor this way

# Slikok Creek 2016: design



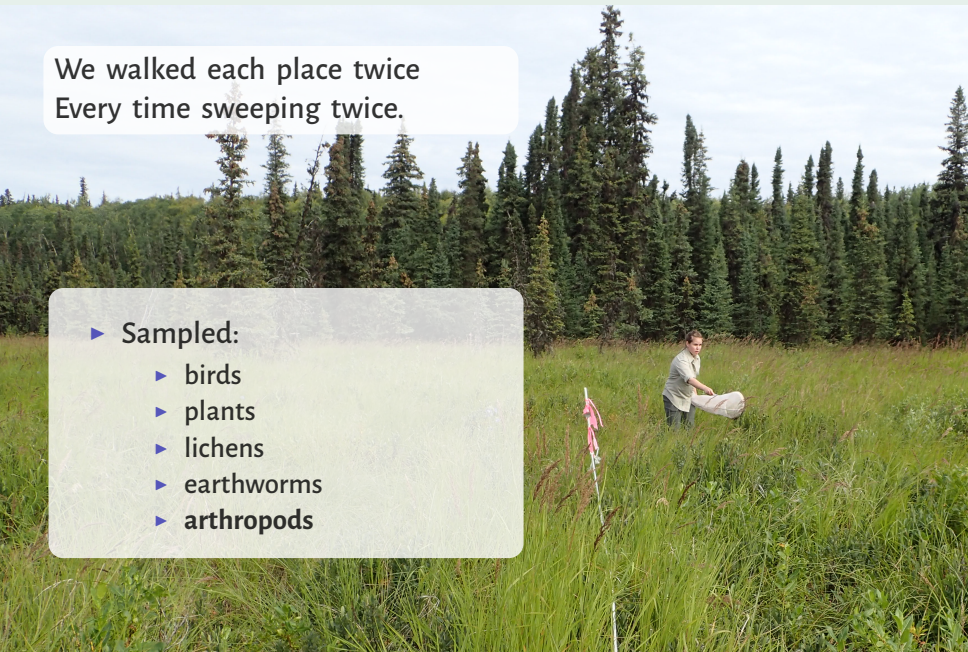
So in 2016 we tried monitoring  
On a grid of 40 places at Slikok  
Creek

# Slikok Creek 2016: field methods

We walked each place twice  
Every time sweeping twice.

▶ **Sampled:**

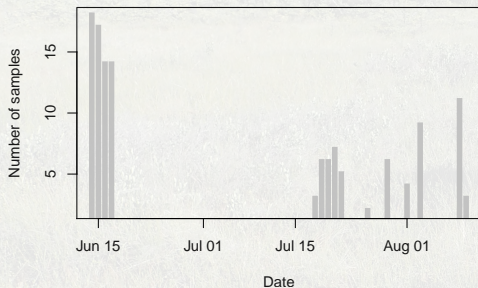
- ▶ birds
- ▶ plants
- ▶ lichens
- ▶ earthworms
- ▶ **arthropods**

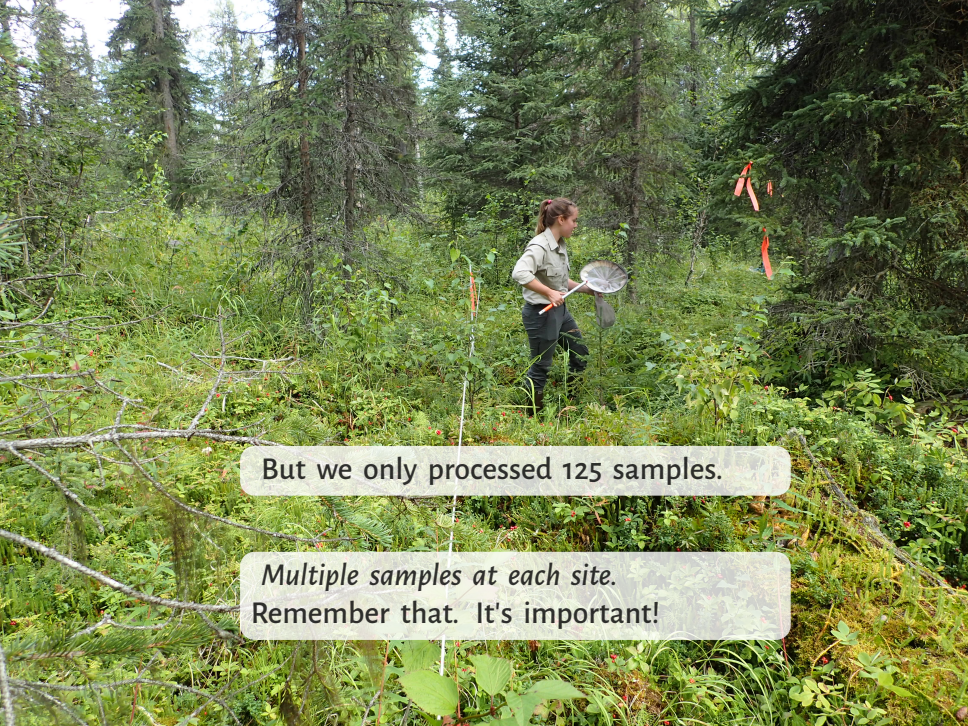


# Slikok Creek 2016: field methods

That's 160 samples — 4 sweeps each.

Number of samples per day





But we only processed 125 samples.

*Multiple samples at each site.*  
Remember that. It's important!



'Cause you really can't tell  
If you missed something

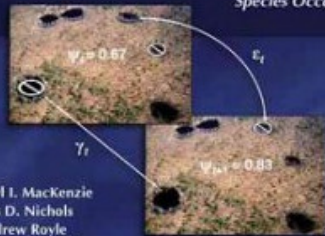


Well, it might not have been there  
Or you might just have missed it!



# Occupancy Estimation and Modeling

*Inferring Patterns  
and Dynamics of  
Species Occurrence*



Darryl I. MacKenzie  
James D. Nichols  
J. Andrew Royle  
Kenneth H. Pollock  
Larissa L. Bailey  
James E. Hines



But with multiple samples and occupancy models  
You can estimate the chance it was there and just missed.

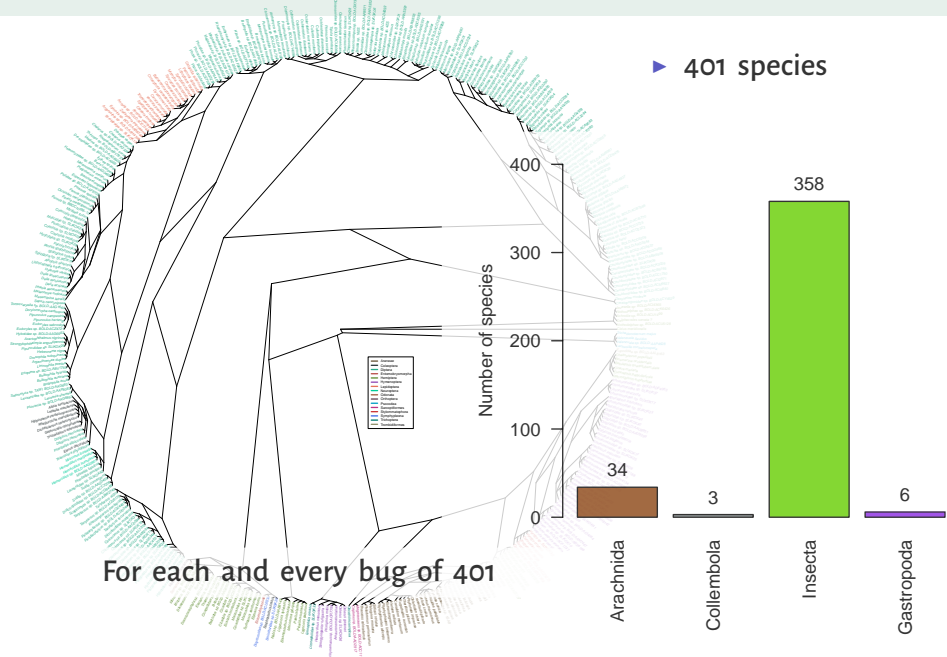




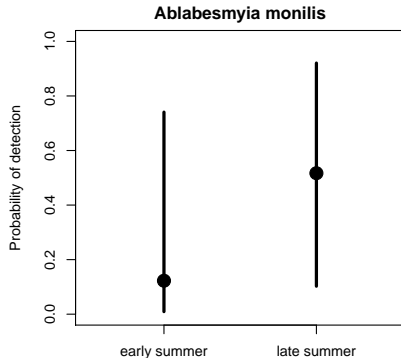
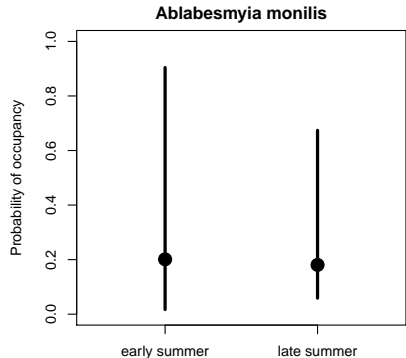
*(instrumental)*

# Slikok Creek 2016: results

► 401 species



# Slikok Creek 2016: results

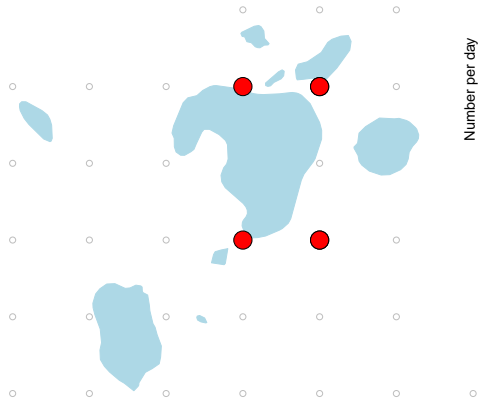


We figured out how likely  
If it's there we would see.

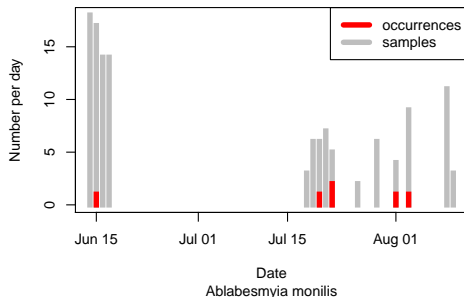


# Slikok Creek 2016: results

## *Ablabesmyia monilis*



## Number of occurrences per day

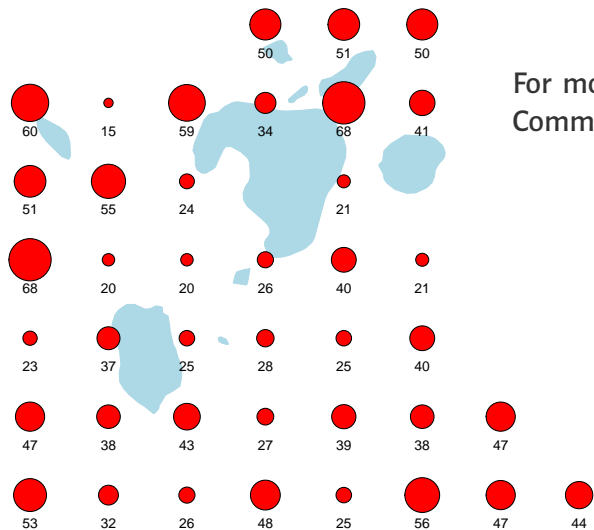


So in short yes, it works  
To metabarcode bugs



# Slikok Creek 2016: results

Number of species per plot



For monitoring insect  
Communities

# Slikok Creek 2016: species

Photo: [http://aegsf.free.fr/V5/\\_media/img/medium/tetragnatha-extensa-pby-arno-s.jpg](http://aegsf.free.fr/V5/_media/img/medium/tetragnatha-extensa-pby-arno-s.jpg).



So yes, it's feasible.

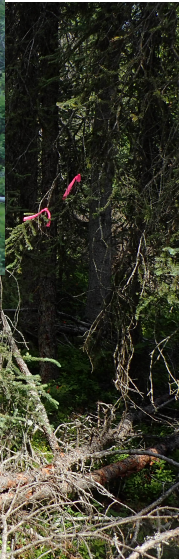
Photo: [https://diptera.info/images/photoalbum/album\\_38/pcampestris.jpg](https://diptera.info/images/photoalbum/album_38/pcampestris.jpg).



Photo: [https://www.brc.ac.uk/schemes/barkfly/images/photos/Valenzuela%20flavidus\\_AO.jpg](https://www.brc.ac.uk/schemes/barkfly/images/photos/Valenzuela%20flavidus_AO.jpg).



It's far more reasonable



And certainly more repeatable





To use DNA

# Acknowledgments

- ▶ John Morton, Dawn Robin Magness, Todd Eskelin, Jennifer Peura, Rebekah Brassfield, Mariah McInnis, Joel Stone, Mallory Okuly, Tracy Melvin, Annie Dziergowski (*Design, support, lab work, field work for Kenai grassland and Slikok creek projects*)
- ▶ Derek Sikes and others, [University of Alaska Museum](#) (*Alaska regional arthropod DNA barcode library*)
- ▶ [Research and Testing Laboratory](#) (*sequencing*)