The University of Alaska Museum Insect Collection’s switch to using Arctos: A review of the good, the bad, and the ugly

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Mission

To create a resource that makes publicly available as much information as possible concerning the non-marine arthropods of Alaska.

Using specimens + literature + ‘grey’ literature

What species occur in Alaska?

Where do these species occur?

What do they do?

Do we really need to know...

All the arthropod species that occur in Alaska?

Where all the species occur?

What all these species do?
Yes:
- research, conservation, natural resource use
- the public constantly has issues with arthropods (in their homes, food, eating them, biting / stinging, transmission of disease)
- arthropods are the largest consumers of vegetation in Alaska (30 million Alaskan spruce trees killed by these animals during the 1990s)
- ecosystem services (decomposition, pollination, food base for large but unknown % of vertebrates)
- climate change - local species ranges may shrink or expand, non-native species may invade
- forensic entomology - insect species and their natural history data can be used to solve crimes

Cumulative AK Species Added to Database

All geo-referenced Alaskan records (3,029) specimen + literature

Globally rare "endemics"?
Alaska Natural Heritage Program

4 insect species listed G1 "critically imperiled" because they are known only from Alaska
25 invert species listed "Species of Greatest Conservation Need (SGCN)" by state ADFG = Data Deficient?

337 species Alaska only
Acarai - 10
Avenae - 1
Araneae - 1
Diplapoda - 1
Coleoptera - 42
Diptera - 131
Hemiptera - 81
Hymenoptera - 81
Mecoptera - 2
Pauropoda - 9
Plecoptera - 2
Protura - 15
Siphonoptera - 1

Tertiary relicts?
1019 species new records for Alaska
(315 new genus, 19 new family, 2 new orders)
13% of total list so far is "new"
32 species new to science

Green Alder Sawfly – *Monosoma pulveratum*
First AK record 2004 – spreading since, Kruse et al. 2010

Preservation of specimens
*and their associated data*
*for perpetuity*

NSF will help us get our data online but ensuring they stay online forever is a problem that hasn't been solved

Database
*home-made*
*weak security*
*mine alone*
*not online*
*unsafe*

[Diagram of database flow and sources]

[Graph showing growth of UAM Insect Collection]
Nov 2011 – March 2012
Transfer of UAM Insect data to Arctos

Major repositories using the Arctos database:
(54 collections of specimens or observations, 1.7M records)

in partnership with
TACC TEXAS ADVANCED COMPUTING CENTER
which is a member of
TeraGrid – A nationwide network
of 11 supercomputing facilities
which is sponsored by
U. S. National Science Foundation’s
Office of Cyberinfrastructure

Arctos: A 15 year history
- MVZ 1995 - Hired Stan Blum to develop relational data model (following modeling by Assoc. Systematic Collections).
- MVZ 1997 - Hired John Wescott to implement model (desktop application) using Sybase and Versata. Partial implementation (e.g., no loans).
- UAM 2003 - Dusty McDonald replaced Versata with ColdFusion, implemented full model (first web-based instance, aka Arctos).
- MVZ: 2009 - Moved hosting of data to Alaska (Virtual Private Database version).
- MVZ/UAM: 2012 – Moved hosting to Texas Advanced Computing Center

ARCTOS
- Specimens (objects) - body parts, tissues, containers, etc.
- Images, media (stored at TACC)
- Projects, permits, publications
- Accessions, loans, usage
- Labels, as PDF files
- Agents, agent activity

ARCTOS
- Arctos treats taxonomic data more or less as "label data"
- Many entomologists need a solid taxonomy database unto itself...
- More on this later
Map of all georeferenced spider records in Arctos 2012-11-14

USFWS – Alaskan Arthropod DNA Barcode Library ~ 2,000 species

Toolik Lake, Arctic Alaska, 2008

Arctos - Dislikes

- Learning curve fairly steep -> back to kindergarten
- Can’t customize to my heart’s content, each change must be voted on & prioritized by other users
- Web access generally slower than I like (we are all more critical of others than ourselves)
- Only available when networked. Field work in remote areas requires special solutions if data are to be accessed.
- User interface is = garish, clunky, industrial (but works)
- Many tasks take longer

Arctos - Likes

- Rock – solid security, the data will outlive me (hopefully)
- Web-published
- Cutting-edge web integration (mapping, GenBank, BOLD, etc)
- No responsibility on my part to maintain backups, software updates, etc. Need only a networked computer
- Arctos programmers & designers are biologists / users who really care about “doing it right”

An example of a paper that resulted from a database search


Searched Arctos for my own spider samples from Toolik Lake

Toolik Lake, Arctic Alaska, 2008
**Wyant et al. 2006** – 3 years of pitfall trapping of spiders
6,981 spiders of 51 species

**Thorough Sampling?**
**Arctic = species poor?**

**Sikes et al. In press** – 1 year, pitfall, net, hand, Berlese
165 spiders of 39 species

**24 were not in Wyant et al. list (64% new)**
new total for site = **75 species**

Lesson –
If the data weren’t digital
This paper wouldn’t exist
Specimens sorted taxonomically, without database – no way to ask “How many from Toolik?”

Arctos taxonomy table – due for major overhaul
Currently a flat file with lots of problems...

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Family</th>
<th>Order</th>
<th>Genus</th>
<th>Species</th>
<th>Description</th>
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<tbody>
<tr>
<td>A. sp.</td>
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<td>sp.</td>
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</tbody>
</table>
“These 2,426,606 records represent current and past taxonomic treatments in Arctos. They are neither complete nor necessarily authoritative.”

Mammal fossils (Proboscidea) with same name as plant genus... Homonym problem

Currently no way to get a list/count of just valid species from a search, or just species

eg

- Heptageniidae  Ecdyonurus simplicioides
- Leptophlebiidae  Leptophlebiidae
- Leptophlebiidae  Leptophlebia sp.
- Leptophlebiidae  Paraleptophlebia ?
- Leptophlebiidae  Paraleptophlebia sp.
- Leptophlebiidae  Paraleptophlebia vaciva
- Leptophlebiidae  Paraleptophlebia debilis
- Metretopodidae  Metretopodidae
- Metretopodidae  Metretopus sp.

Cumulative AK Species Added to Database

2008 - funding from Alaska EPSCoR
GBIF

Not accepting Arctos UAM Insects data

Only 10,893 records from prior to March 2012 upload of 170,000

Problem due to strange characters in uploaded data

Data cleaning of Jan 15, 2013 will hopefully fix UAM Insect Observation Collection – "literature" records

Run live demo of USDA BigBug search

GBIF

UAM Insect Observation Collection – "literature" records

Alaska Endemics
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- NPS
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