Entomological data in Arctos: Uses inside and out of the museum

Derek Sikes & Sarah Meierotto
University of Alaska Museum
Fairbanks, AK

Entomological Collections Network
Portland, OR 2014-11-15
Why having a mostly databased collection is awesome

Derek Sikes & Sarah Meierotto
University of Alaska Museum
Fairbanks, AK
THE INSECT AND SPIDER COLLECTIONS OF THE WORLD

By

Ross H. Arnett, Jr.
Florida State Collection of Arthropods
Gainesville, Florida

G. Allan Samuelson
Bishop Museum
Honolulu, Hawaii

and

Gordon M. Nishida
Bishop Museum
Honolulu, Hawaii

SECOND EDITION

1993
ALASKA

[No known collection of insects in Alaska.]

ARIZONA

Flagstaff

COLLECTION OF INSECTS, BOX 5640, BIOLOGY, NORTHERN ARIZONA UNIVERSITY, FLAGSTAFF, AZ 86011. [NAUF]
Director: Dr. C. Dan Johnson. Phone: (602) 523-2505. Professional staff: Dr. R. S. Beal, Dr. C. N. Slobodchikoff. About 1.2 million specimens are housed in 110 cabinets with 1,320 drawers. Coleoptera are best represented with excellent ecological supporting data for the Bruchidae. Insects are especially well represented from the Southwest, Mexico, Central and South America. [1986]

Grand Canyon

SCIENTIFIC STUDY COLLECTION, GRAND CANYON NATIONAL PARK, GRAND CANYON, AZ 86023. [GCNP]
Curator: Carolyn Richard. Phone (602) 638-7769. There are approximately 6,000 insects in the collection, including numerous butterflies, moths, and beetles. There are a few type specimens from Grand Canyon subspecies. [1992]

Portal

SOUTHWESTERN RESEARCH STATION OF THE AMERICAN MUSEUM OF NATURAL HISTORY, PORTAL, AZ 85632. [SWRS]
Director: Dr. Wade C. Sgerbrooke. Phone: (602) 558-2396. The collection consists of about 14,000 specimens (no long series) of the insects of the Chiricahua Mountains and surrounding valleys. It is housed in drawers in cabinets. Most of the material is identified at least to genus. There is a good collection of arachnids from the area, all identified to species [1992].
Entomology NMNH
entomology.si.edu/collections.html - Smithsonian Institution
description of the insect collections at the National Museum of Natural History, Smithsonian Institution, Washington, DC, with links to lists and databases.

Collections - | Biodiversity Institute & Natural History Museum
naturalhistory.ku.edu/collections - University of Kansas Natural History Museum
The Biodiversity Institute collections include 9 million specimens of plants, ... The entomology collection includes almost 5 million specimens of insects from all...

Entomology | Collections : Yale Peabody Museum of Natural...
peabody.yale.edu/collections/entomology - Peabody Museum of Natural History
The systematic collections of the Yale Peabody Museum's Division of Entomology comprise over one million curated specimens.

Collections & Archives | Entomological Society of America...
www.entsoc.org/.../collections_archive - Entomological Society of America
Indexes to Collections International Society of Arachnology (ISA) Insect and Spider Collections of the World Iowa State Entomology Index: Collections U.S. ...

Entomology | Museum - University of Alaska Fairbanks
www.usf.edu/museum/collections/entom/ - University of Alaska Fairbanks
Overview Welcome to the University of Alaska Museum Entomology Web Page. The collection was established as part of a NSF-funded Arctic Archival ...

Full List of Insect and Spider Collections
hbs.bishopmuseum.org/codens/codens-inst.html - Abbreviations for Insect and Spider Collections of the World ..... Consortium for Natural Science Collections, Department of Biology Laboratory of Entomology.

Entomological Collections Network: Welcome
www.ecnweb.org/ - The Entomological Collections Network is a long standing organization whose mission is to disseminate information about best practices in entomological (and ...

Research Collections | Entomology | MCZ | Harvard
www.mcz.harvard.edu/.../Entomology/holdings.html - Harvard University
Holdings. The insect collection of the Museum of Comparative Zoology is among the richest and historically most significant in North America, containing more ...

Entomology | MCZ | Harvard
www.mcz.harvard.edu/Departments/Entomology/ - Harvard University
Entomology Department. About the Department ... Search the MCZ Collections Database. Hesperia nobakowi ... Photo: Entomology Department. Formica Impacta ...
Map of all records (38,664) in Arctos 2014-11-11 collected by D. Sikes

= 98,827 specimens
Outline

1. Uses inside the museum
   1. Labels
   2. Finding specimens not yet ‘installed’
   3. DNA barcoding
   4. Reporting

2. Uses outside the museum
   1. Loans – loanees can get a spreadsheet of all the data
   2. Voucher specimens links to publications
   3. GBIF downloads
Numbers...

Administrators really like numbers

Saying “We have a lot specimens” doesn’t seem to impress them very much.

Only 8% of the data in GBIF are entomological.

This is sad, it should be more like 92% entomological!

We are entering a new era of *Big Data*
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

Which species occur in Alaska?

Where do these species occur?

What do they do? / Are they changing?
Cumulative AK Species Added to Database

- **All Alaskan species**: 8,288 species
- **UAM specimen based species**: 3,140 species
- **DNA barcoded species**: 1,073 species

Date range from 5/1/07 to 11/1/14.
82% of 212,082 records collected post 2000
Processing Protocol

1. Field collected samples (eg 30 coll. events)
2. Bulk samples entered as 30 records
3. Lab techs prepare samples -> eg 2,000 specimens / vials
4. Barcodes are assigned to each
5. Database is used to ‘clone records by barcode’ so (eg) 2,000 records are made from the original 30, all identified as ‘Arthropoda’
6. Specimen/vial labels are prepared from database
7. Specimens labeled, sorted to order then morphospecies
8. Identifications are made & barcodes scanned to find records to update their IDs
What is a record?

One species:
one record = one specimen (eg beetle on pin)
one record = multiple specimens (eg spiders in vial)

Multiple species:
one record = one specimen stored in vial with other specimens of different species (many records, one vial)
What is a record?

212,082 specimens -> wrong, 212,082 \textit{records}

actually closer to 1.15M \textit{specimens}

Identified to species = 90,107 records (137,342 specimens)

42\% of records ID’d, 12\% of specimens
Caveat emptor

“Continuing emphasis on the mere computerization of label data from museums and herbaria is misguided, when eight out of 10 records may be mistaken. There is limited benefit in rapid electronic access to unreliable data.” – Q. Wheeler

If you were about to revise a taxon would you prefer to borrow undatabased specimens or databased specimens?

-10,000+ specimens undatabased, MS student cannot database them all = ~ $30,000 for grad student, 8 months of databasing 8h/d for 5d/wk.

Caveat emptor
Caveat emptor

- IDs may be incomplete or wrong prior to revision but georeferencing should be highest quality

- ALL specimens should be databased by their home institutions

- Too many revisions database specimens but the data are not available
Identification comparison (Mar – Nov 2014)

$39,000 from AK Dept Fish & Game
- $19,972 – traditional IDs
- $10,713 – DNA barcoding

1. Aleocharinae by Jan Klimaszewski
2. Araneae by Jozef Slowik
3. Staphylinidae by Thayer & Newton
4. DNA barcoding
Identification comparison

1. Aleocharinae by Jan Klimaszewski
   1,872 specimens
   1,738 to species

2. Araneae by Jozef Slowik
   6,829 records (21,994 specimens)
   4,651 records (16,649 specimens) to species

3. Staphylinidae etc. by Newton & Thayer
   3,830 specimens
   1,157 to species

TOTAL: 27,696 specimens identified, 19,544 to species
DNA Barcoding

10 plates of legs sent of unidentified specimens
Coleoptera, Hymenoptera, Diptera

specimens sent 950
Barcodes 601
ID improvement 562
Confident species IDs 161 (27% of 601)

number of confident spp IDs / No. succ barcoded

Coleoptera 13 / 82 15%
Hymenoptera 85 / 338 25%
Diptera 62 / 181 34%
Cost Comparison

Traditional identifications \(\$19,972\)

27,696 specimens identified, 19,544 to species

\[\text{= $1 per specimen}\]

DNA barcoding IDs \(\$10,713\)

562 specimens identified, 161 to species

\[\text{= $71 per specimen} \quad \text{(if all 950 had worked would have been $11 each)}\]
Smithsonian Curation Standards and Profiling System

LEVEL 1: materials conservation
LEVEL 2-4: specimen accessibility
LEVEL 5-6: physical organization
LEVEL 7-9: data capture
LEVEL 10: scientific voucher material

- DNA barcoded specimens, imaged
- GenBank vouchers
- Vouchers for publications
  = LEVEL 10
29,241 of these specimen records have been cited or otherwise used in 23 peer-reviewed publications.

3,237 have BOLD or GenBank #s
A redescription of *Lyrosoma pallidum* (Eschscholtz) and distributional range extension of *Lyrosoma* Mannerheim (Coleoptera, Agyrtidae)

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Corresponding author: Kee-Jeong Ahn (kjahn@cnu.ac.kr)

Academic editor: Michael Ivie | Received 4 March 2013 | Accepted 26 August 2013 | Published 5 September 2013

**Citation:** Yoo I-S, Sikes D, Ahn K-J (2013) A redescription of *Lyrosoma pallidum* (Eschscholtz) and distributional range extension of *Lyrosoma* Mannerheim (Coleoptera, Agyrtidae). ZooKeys 329: 23–32. doi: 10.3897/zookeys.329.4957

**Abstract**

A redescription with illustrations of the species *Lyrosoma pallidum* and a key to the Korean species of the family Agyrtidae are provided. New distributional data, including a range extension, of the two *Lyrosoma* Mannerheim species are presented. *Lyrosoma pallidum* (Eschscholtz) is recorded for the first time in Korea.

**Keywords**

*Lyrosoma pallidum, L. opacum*, distribution range, coastal, Agyrtidae
to the Korean fauna. Newton (1997) classified Lyrosoma under Agyrtinae (one of the three subfamilies, sensu Newton 1997) based on abdominal-elytral interacting system and structure of aedeagus, and discussed its phylogenetic relationships with other genera. Later, Schawaller (1998) revised the genus Lyrosoma, synonymizing six species, thereby reducing the genus from eight species to only two species, and also reported its distributional range along northern Pacific coasts. However, the description of L. pallidum was insufficient, lacking important features such as mouthparts and body sculpture and the distributional data were sparse and incompletely mapped. Here, we present a redescription with a habitus photograph and illustrations of Lyrosoma pallidum, provide improved distribution data for both species, a range extension for L. pallidum, and a key to the Korean species of Agyrtidae.

Material and methods

All L. pallidum specimens used in this study are deposited in the Chungnam National University Insect Collection (CNUIC), Daejeon, Korea. New data for L. opacum are from specimens deposited in the University of Alaska Museum Insect Collection (UAM), Fairbanks, Alaska, USA. These data and all literature records reported here for L. opacum are available online at http://arctos.database.museum/saved/Lyrosoma_opacum. Digital images of habitus were merged using image stacking software (Combine ZP). For measurement, we selected 10 males and 10 females (2♂1♀ from Korea; 5♂6♀ from Japan; 3♂3♀ from Russia) with maximum body size variation. The following abbreviations were used in the text: BL, body length (HL+PL+EL); HL, length of head from the anterior margin of the clypeus to the posterior margin of head; HW, width of head, including the eyes; PL, maximum length of pronotum; PW, maximum width of pronotum; EL, length of elytron from the base to the posterior margin of elytron; EW, width of elytra.
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- Annotate
- 19 Cited Specimens
- http://dx.doi.org/10.1007/s10682-014-9734-7
- Edit
- Manage Citations


- Annotate
- 1 Cited Specimens
- http://dx.doi.org/10.1016/j.ympev.2006.04.013
- Edit
- Manage Citations


- Annotate
- 2 Cited Specimens
- http://dx.doi.org/10.3897/zookeys.327.5908
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- Manage Citations


- Annotate
- 1 Cited Specimens
- Edit
- Manage Citations


- Annotate
- 6547 Cited Specimens
- Edit
- Manage Citations
Anthocoris aquilivenis

Animalia; Arthropoda; Insecta; Hemiptera; Anthocoridae; Anthocoris aquilivenis Lewis 2012

Identified by Tamara Lewis on 2012

Nature of ID: type specimen

Remarks: PARATYPE

Anthocoris n.pl. Lewis

Identified by Tamara Lewis on 2012

Nature of ID: expert

Remarks: to be paratype, n.pl. aquilivenis; manuscript in prep 2012

Citations

paratype of Anthocoris aquilivenis, page 482 in Lewis & Horton 2012

Determination Type: accepted place of collection

assigned by Gaetan Milet on 2007-06-13

Higher Geography: North America, United States, Alaska

Specific Locality: Becharof NWR Upper Kejulik

Collecting Method: sweep

Collecting Source: wild caught

Event Date: 2007-06-13

Verbatim Date: 13 June 2007

Verification Status: checked by curator

Coordinates: 57.97709/-155.50765

Verbatim Coordinates:

57.97709/-155.50765

Datum: North American Datum 1983

Error: 50 m

Georeference Source: GPS

Georeference Protocol: not recorded

Elevation 82 to 82 m

No Media Found
Small collections make a big impact

In an era in which support for natural-history collections is waning, we wish to point out how effective even a small, young collection can be.

We constructed a Google Scholar profile (called UAM Birds) of publications that used the bird collection we oversee at the University of Alaska Museum in Fairbanks. The collection is supported by 1.3 full-time-equivalent staff, and it served in whole or in part as research infrastructure for these publications, contributing and preserving specimens and associated information.

The body of work supported by the collection is diverse and well cited, with a profile $h$-index of 42, equivalent to an average Nobel laureate in physics (J. E. Hirsch Proc. Acad. Natl Acad. Sci. USA 102, 16569–16572; 2005). This positively sings ‘good investment’ and should encourage other institutions to rediscover and reinvest in collections as important societal resources.

Kevin Winker, Jack J. Withrow
University of Alaska Museum, Fairbanks, Alaska, USA.
kevin.winker@alaska.edu
<table>
<thead>
<tr>
<th>Title</th>
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<tr>
<td>Latitudinal patterns in leaf litter breakdown: is temperature really important?</td>
<td>230</td>
<td>1994</td>
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<tr>
<td>JG Irons III, MW Oswood, R STOUT, CM Pringle</td>
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<tr>
<td>Freshwater Biology 32 (2), 401-411</td>
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<td>Consumption of leaf detritus by a stream shredder: influence of tree species and nutrient status</td>
<td>96</td>
<td>1988</td>
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<td>JG Irons, MW Oswood, JP Bryant</td>
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<tr>
<td>Hydrobiologia 160 (1), 53-61</td>
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<tr>
<td>The carrion beetles of Canada and Alaska. Coleoptera: Silphidae and Agrytidae.</td>
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<td>RS Anderson, SB Peck</td>
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<td>Insects and Arachnida of Canada</td>
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<td>Ecological adaptations of aquatic macroinvertebrates to overwintering in interior Alaska (USA) subarctic streams</td>
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<td>JG Irons III, LK Miller, MW Oswood</td>
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<td>Canadian Journal of Zoology 71 (1), 98-108</td>
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<tr>
<td>Community structure of benthic invertebrates in interior Alaskan (USA) streams and rivers</td>
<td>41</td>
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<td>MW Oswood</td>
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<td>Hydrobiologia 172 (1), 97-110</td>
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<tr>
<td>Biology of Alaskan black flies (Simuliidae, Diptera)</td>
<td>40</td>
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<td>KM Sommerman, RI Sailer, CO Esselbaugh</td>
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<tr>
<td>Ecological monographs 25 (4), 345-385</td>
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<tr>
<td>Collection</td>
<td>Downloads</td>
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<td>UAM Fish Collection</td>
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<td>UAM Mammal Collection</td>
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<td>UAM Herbarium</td>
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<td>UAM Earth Sciences Collection</td>
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<td>UAM Bird Collection</td>
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<td>UAM Entomology Observations</td>
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<td>UAM Entomology Collection</td>
<td>46,078,027</td>
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<td><strong>Total for UAM</strong></td>
<td><strong>171,049,951</strong></td>
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## iDigBio usage (~ 3 months prior to 3 Oct 2014)

### Top 10 Entomological datasets

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<th>Name</th>
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<th>downloaded</th>
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<td>Snow Entomological Museum Collection</td>
<td>334,176,628</td>
<td>5,602,928</td>
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<td>Illinois Natural History Survey</td>
<td>210,111,982</td>
<td>3,599,583</td>
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<td>AntWeb</td>
<td>148,328,835</td>
<td>2,835,370</td>
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<td>Tri-Trophic Interactions Dataset</td>
<td>121,938,641</td>
<td>2,130,753</td>
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<td>C.A. Triplehorn Insect Collection (OSUC)</td>
<td>98,420,400</td>
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<td>CAS Entomology (ENT)</td>
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<td>53,897,870</td>
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<td>Texas A&amp;M University Insect Collection</td>
<td>49,864,841</td>
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<td>Tri-Trophic Interactions – Texas A&amp;M</td>
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<td>674,322</td>
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<tr>
<td>Michigan State University ?</td>
<td>32,882,294</td>
<td>509,854</td>
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</table>
Example of research results
Toolik Lake, Arctic Alaska, 2008
Wyant et al. 2006 – 3 years of pitfall trapping of spiders
3642 trap days
6,981 spiders of 51 species
2 sites ~2km apart

Thorough Sampling? Arctic = species poor?
1 year, pitfall, net, hand, Berlese
174 trap days
165 spiders of 39 species
24 were not in Wyant et al. list (64% new)
new total for site = 75 species

USDA Agricultural Research Service
Bombus study 2009-2010

8,482 specimens + others in UAM = 22,956 specimens
Acknowledgments

- Graduate Curatorial Assistants
  Jill Stockbridge
  Joey Slowik
  Brandi Fleshman

- Many entomologists

- Lab techs:
  Sayde Ridling
  Trista Crass

- Volunteers:
  Steve Peek (Diptera)
  Mary Wyatt

- National Science Foundation
- USDA ARS / FHP
- USFWS
- NPS
- ADFG
- AK Div of Ag
- USGS
Questions?