

# Newsletter

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## First record of a cluster fly (Calliphoridae: *Pollenia*) in Alaska

by Matt Bowser<sup>1</sup>



Figure 1: Adult female *Pollenia vagabunda*, February 17, 2015 (specimen record: KNWR:Ento:10698). Original image: <http://arctos.database.museum/media/10453039>.

During an extended warm period this February, cluster flies (Calliphoridae: *Pollenia*, Figure 1) were one of the

most abundant and conspicuous insects in the vicinity of the Kenai National Wildlife Refuge's headquarters building south of Soldotna. Adam Jewiss-Gaines (Brock University, St. Catharines, Ontario) identified a specimen as *Pollenia vagabunda* (Meigen, 1826). Thirty-five specimens were collected in the Soldotna area 11<sup>th</sup> of February to the 17<sup>th</sup> of March, where they were found in spider webs, in buildings, on snow, and sunning on any warm aspect in the afternoons. To the best of my knowledge, this is the first report of a cluster fly from Alaska.

Cluster flies are native to the Old World, but have become established across much of North America. Until recently, all cluster flies collected from the Nearctic were considered to be one species, *Pollenia rudis* (Fabricius), but now six species are recognized from North America (Whitworth, 2006; Jewiss-Gaines et al., 2012). *Pollenia vagabunda* was first collected in North America in 1958 and is now distributed from the East Coast to southern British Columbia (see distribution map of Jewiss-Gaines et al., 2012).

The biology of *P. vagabunda* is unknown. The best-studied species of *Pollenia* are parasites of earthworms, with the third instar larvae sometimes acting as earthworm predators (Rognes, 1987). Honey bees (Ibrahim, 1984) and land snails (Coupland and Barker, 2004) have also been reported as hosts of cluster flies. Two species of *Pollenia*, including *P. vagabunda*, have been reported from noctuid moths of the subfamily Hadeninae: *Pollenia ibalia* Séguy from *Spodoptera exigua* (Hübner) (Rognes, 2010) and

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*P. vagabunda* from *Sesamia nonagrioides* (Lefebvre) (Rognes, 1992). *Chondrostega maghrebica* De Joannis (Lepidoptera: Lasiocampidae) was given as a host of *Pollenia rudis* by Séguéy (1934).

Some species of *Pollenia* overwinter as adults, often entering buildings in large numbers where they form their namesake clusters of overwintering flies. Adult cluster flies are among the first flies to emerge on early spring days (Jewiss-Gaines et al., 2012). Later in the spring, they can be one of the more abundant pollinators on flowers (Jewiss-Gaines et al., 2012). In Fennoscandia and Denmark *P. vagabunda* has been collected throughout the year (Rognes, 1992).

Specimen records: USA: Alaska: Soldotna, 300 West Marydale Avenue, Soldotna Bible Chapel, 60.495713°N, 151.087998°W ±20m. 15 Feb 2015. Matt Bowser. on outside of building. (♀ KNWR:Ento:10690); Soldotna, Sterling Highway and Kalifornsky Beach Road, Soldotna Visitors Center, 60.476185°N, 151.083799°W ±30m. 17 Mar 2015. Matt Bowser. sunning on side of building. (♀ KNWR:Ento:10728, ♂ KNWR:Ento:10729); Soldotna, Ski Hill Road. Radio tower at shop area, 60.46407°N, 151.081044°W ±20m. 24 Feb 2015. Matt Bowser. sunning on trunk of birch tree near ground. (♂ KNWR:Ento:10710); Soldotna. Ski Hill Road. Kenai NWR shop area, canoe shed, 60.463802°N, 151.080725°W ±15m. 27 Feb 2015. Matt Bowser. equipment shed. (♀ KNWR:Ento:10713, ♀ KNWR:Ento:10714, ♀ KNWR:Ento:10715, ♀ KNWR:Ento:10716, ♂ KNWR:Ento:10717, ♂ KNWR:Ento:10718, ♂ KNWR:Ento:10719, ♀ KNWR:Ento:10720, ♂ KNWR:Ento:10721); Soldotna. Ski Hill Road. Kenai NWR shop area, Biohut, 60.463745°N, 151.080457°W ±15m. 27 Feb 2015. Matt Bowser. equipment shed. (♀ KNWR:Ento:10712); Soldotna, Ski Hill Road. Kenai National Wildlife Refuge headquarters building, 60.464699°N, 151.072967°W ±30m. 11 Feb 2015. Matt Bowser. crawling on snow over grass lawn by building. (♂ KNWR:Ento:10689); 13 Feb 2015. Matt Bowser. dead on ground and in cobwebs on side of building. (♀ KNWR:Ento:10692, ♂ KNWR:Ento:10693, ♂ KNWR:Ento:10694, ♂ KNWR:Ento:10695, ♀ KNWR:Ento:10696); on bare soil at edge of lawn under eave of building. (♀ KNWR:Ento:10691); 17 Feb 2015. Matt Bowser. on side of building. (♀ KNWR:Ento:10697); on snow on lawn by building. (♀ KNWR:Ento:10698); 18 Feb 2015. Matt Bowser. on outside of building. (♂ KNWR:Ento:10699); 19 Feb 2015. Matt Bowser. dead on floor of men's restroom. (♂ KNWR:Ento:10700); 20 Feb 2015. Matt Bowser. dead on sidewalk. (♂ KNWR:Ento:10703, ♀ KNWR:Ento:10704, ♂ KNWR:Ento:10705); 24 Feb 2015. Matt Bowser. dead on snow. (♂ KNWR:Ento:10707, ♀ KNWR:Ento:10708, ♂ KNWR:Ento:10709); Matt Bowser, Todd Eskelin. Sunning on side of building. (♂ KNWR:Ento:10706); 25 Feb 2015. Matt Bowser. sunning on side of building. (♂ KNWR:Ento:10711); 09

Mar 2015. Matt Bowser. sunning on side of building. (♂ KNWR:Ento:10722); 17 Mar 2015. Matt Bowser. sunning on side of building. (♂ KNWR:Ento:10727).

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# What is a specimen? What should we count and report when managing an entomology collection?

by *Derek S. Sikes*<sup>1</sup>

A fundamental unit of an entomology collection is the specimen. However, in most cases the term 'specimen' is used non-literally as a shorthand for 'collection object'—be that a pinned beetle, a vial of spiders, a slide of thrips or an envelope of dragonflies, and thus when tallied would not be an actual count of specimens in a collection. Collection-object-specimens, in this sense, are things to which a unique identifier can be attached. The specimens inside a jar of hundreds of specimens cannot have unique identifiers physically attached to the specimens, so these specimens are generally referred to as 'bulk,' unsorted, uncurated, material that is of lower value, but still worth keeping. Databases built on the model of one record equals one specimen often refer to counts of records as counts of specimens (as ours, Arctos, does). Ambiguity of the term 'specimen' exists outside of entomology too. Molloy et al. (1992) describe problems in Botany, relating to their nomenclatural code, stemming from the practice of multiple specimens on one herbarium sheet, or one specimen spanning multiple herbarium sheets.

Because it is confusing to explain to people the difference between literal specimens and collection-object-specimens, I have for the past eight years reported the size and growth of the University of Alaska Museum Insect Collection as a count of "specimens" with that count being equal to a count of the records in our database. Presumably most curators do the same when reporting on the collections under their care (if their databases are anywhere near complete). It has recently come to my attention that there is a large discrepancy in our collection between the number of specimens and the number of database records, which prompted this detailed examination of what to call what we count, and what to report about the size of our collections.

As I detail below, there are many cases where one might want to report the actual number of specimens rather than 'collection objects' but doing so is made confusing because the entomological community, in certain contexts, has been using the term 'specimens' to mean something other than literal specimens. I conclude, after much reflection, that there is no easy solution. The traditional collections-based definition of specimens as 'collection-object-specimens' is too entrenched to dislodge and attempts to do so would only increase rather than decrease confusion. It should be obvious what is meant from the context, but issues remain.

First, some background on different entomological storage methods and how these relate to counts of specimens.

The most common storage methods are hard bodied insects on pins and soft bodied insects and other arthropods in vials of ethanol. Additional storage methods include dragonflies in clear envelopes (which saves considerable storage space relative to pinning these large insects with their wings spread—a drawer can hold hundreds of envelopes but perhaps only a few dozen pinned dragonflies) and small specimens such as mites, aphids, thrips, and fleas on glass slides. All these storage methods allow a unique identifier to be associated with the one or more specimens in the container (or on the pin) and that identifier allows that specimen (or specimens) to be unambiguously cited in a publication. There are also 'bulk' storage methods of uncurated, unsorted specimens, which although the specimens can be identified and counted, usually no unique identifier can be unambiguously associated with a particular specimen.

The simplest cases, where a count of collection objects equals a count of specimens, would be an insect on a pin or a single dragonfly in an envelope. When one is digitizing the data for these, each becomes a record in a database and the count of such records is equal to the count of specimens. It is slightly more complicated but standard to database lots as a single record, for example, a vial of spiders of the same species from the same collection event would be databased as a single record with a count of the spiders inside recorded in the individual count field. Thus ten vials of spiders might contain a total of 35 spider specimens and represent ten records in a database. All collections databases should have a field to keep track of the number of specimens in a lot (a vial, jar, slide, envelope, etc., even pinned specimens can come in lots as will soon be described).

Things can get much more complex. What if that single beetle or dragonfly has phoretic mites that would be good to document in the database so they can be easily found and studied later? In such a case the single envelope would result in two database records, one for the dragonfly specimen and one for the mites. The mites could be counted and this added to the mite record. The single envelope then becomes perhaps 30 specimens and two database records. Even beetles on a pin can sometimes come in multiples. If a male and female were caught mating these are sometimes mounted together on a single pin (one database record, two specimens, one pin). A bulk sample of Berlese residue could be databased as a single record with an identification of 'Animalia,' or to increase its value this sample could be examined and each higher taxon within identified and given its own record in the database. Thus one bulk sample might have eight records with one each for Coleoptera,

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Diptera, Hymenoptera, Collembola, Acari, Thysanoptera, Chilopoda, and Mollusca. All records would share the same container of the single jar with a barcode. This would make it much easier to pull together all the bulk samples that contain taxa of interest which might otherwise be missed if the jar was a single record identified only as 'Animalia.'



Figure 1: Multi-mounted ants from the Mogens Nielsen Alaskan ant collection.

In 2011 the University of Alaska Museum Insect Collection received a donation of pinned ant specimens collected and prepared by Mogens Nielsen from the early 1980s. This collection was databased as 598 records (because there were 598 pins) of ten species and 845 specimens. A large number of these ants are multiples on a pin because they had been collected from the same nest and Nielsen decided to double or triple mount them (Figure 1). We could have chosen to make these into 845 rather than 598 database records by giving each specimen a record and a descriptor indicating its position in its mount to allow unambiguous association of each specimen with its database record.

Multiple species can be in a container (vial, envelope) temporarily—that is, until they've been further curated and

split out into multiple containers, or multiple species can be in a container indefinitely. Mites on a beetle can be databased before they are removed from the beetle. If they are removed and stored in a vial, or on a slide, the database can be updated to their new container types. We recently received a donation of Strepsipteran parasites and their delphacid hosts. These are in eight vials but they are represented by 15 records in Arctos and include 100 specimens (71 delphacids, 29 strepsipterans). All but one vial contains two taxa (host and parasite). Although some of the parasites could be removed to their own vials, most are females embedded in their hosts so we chose to leave these as mixed-taxon vials (to be physically stored among the Strepsipterans).

The University of Alaska Museum Insect Collection is working with an enormous butterfly collection, that of the late Kenelm Philip, most of which will eventually be transferred to the Smithsonian following Ken's wishes. The inventory, led by lab technician Kathryn Daly, is now complete—a total of 127,973 specimens (a mix of butterflies and moths with a few non-Lepidoptera). When we database this collection we put barcodes on 'collection objects'—either envelopes or pinned specimens. Envelopes, like vials, can contain multiple specimens.

Ken had two envelope collections—unprocessed field envelopes (which will ideally need curation at some point to move the specimens either onto pins or into curated envelopes) and fully processed curated collection-event envelopes. These curated envelopes have full collection data on the outside and a list of species inside and a count with sexes of each (Figure 2). They are curated well enough that they are likely to remain in these envelopes indefinitely (in part because these specimens are all 'extras' that Ken decided were not worth spreading). Envelopes formed a large percentage of Ken's collection. A total of 37,389 specimens in curated envelopes, 37,151 specimens in field envelopes, and 49,636 pinned specimens—thus enveloped specimens represent 74,540 specimens (60%) of the total 124,176 specimens. When we database these envelopes we make a separate record for each species—so an envelope with one barcode on the outside but five specimens of three species inside will become three records in our database (one collection object bearing a unique identifier, five specimens, three database records—one for each species).

Thus, the records in our database, Arctos, will not equal the number of envelopes (but we can get this count if needed), nor will it equal the number of butterfly specimens (also available if needed). These Arctos records will represent the number of species occurrences (one species collected from one place/time).

My former MS student, Joey Slowik, works with spiders and if we query the database we find he's identified 13,031 records (which Arctos calls 'specimens'). However, because these are spiders in vials, the actual specimen count is much

higher (39,021 specimens). When he identifies spiders he has to examine each specimen. The effort he spent identifying these spiders is not accurately represented by the 13,031 count of records in the database.

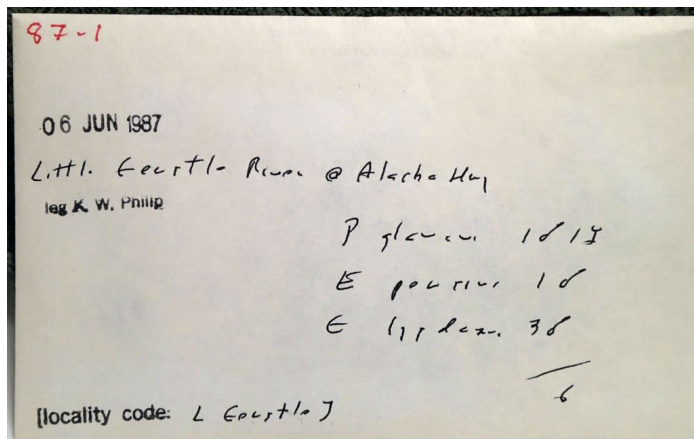


Figure 2: Curated collection-event envelope of butterflies from the Kenelm W. Philip collection with full collection data, species identifications, and specimen counts by sex.

Another former graduate student, Jill Stockbridge, as part of her thesis using beetles and spiders as ecological indicators on Prince of Wales Island, Alaska, prepared a pinned collection of 7,325 beetle specimens which are represented by 7,291 records in Arctos. The pinned collection is only the synoptic set—the majority of the beetle specimens are stored in mixed-taxon vials and comprise a total of 35,635 specimens in 2,956 vials represented by 10,187 records in Arctos. We mounted only one unit tray per beetle species (with the exception of aleocharine staphylinids, which we mounted every specimen) to avoid filling many drawers and cabinets with long series of common species—all those ‘extras’ are in vials with other species from the same sample. They are all identified to species or morphospecies and counted in the database, but not very accessible to researchers. If someone really wanted these we could find the vials and loan them out. Thus, there are two sorts of bulk samples—unidentified and uncounted, versus those that are identified and counted. Obviously the latter type are more valuable than the former, but still of lower research value than non-bulk specimens.

If a collection loses specimens either by exchange or physical loss (eg in the mail—as we unfortunately experienced once) should the curator delete those records from the database? The answer to this question might differ among curators and I think it will depend on whether they consider their database a collections management tool only, or a dataset of biological information. If tragedy struck and a large collection of a million databased specimens was destroyed in a fire should the database records for all those specimens be deleted? I hope everyone reading this would

agree that they should not. In such a tragic case obviously those million missing specimens would not be reported as ‘present’ in the collection, but the database counts would not match the specimen-present counts.

From all these examples I hope it’s clear that there are many cases when the number of records in a database do not equal the number of specimens in a collection. Nor does the number of records in the database necessarily equal the number of collection objects (if multiple taxa, represented by multiple records, are stored in one container). This leaves the count of records in a database a fairly difficult thing to interpret and explain unless one’s collection is basically of a single type such as pinned insects with no more than one specimen per pin and/or vials with no more than one species per vial—which most large collections presumably are to a large extent.

Despite these issues with interpreting the meaning of a database record, the entomological community traditionally reports collection size as the number of database records—but when doing so these are invariably and, I argue, inappropriately, called ‘specimens.’ So for example, a collection might report its size as “6.9 million specimens” (Table 1). All collections-based entomologists assume that this use of the word specimens is shorthand for ‘specimens/lots’ and is thus a count of pinned specimens combined with collection objects/containers such as vials, jars, envelopes, slides etc. This is a safe assumption but science as an enterprise requires precision of language to ensure proper communication and I for one would like the term ‘specimens’ to mean ‘specimens.’ Otherwise it becomes confusing when one wants to enumerate actual specimen counts.

This historical tendency to focus on counting ‘collection objects’ is likely a result of these objects (vials, jars, slides, etc) being the things that takes up physical space in a collection, and being the things that are easier to count and associate unique identifiers with. But for various reasons, it’s valuable to know actual specimen counts. Now that collections are databasing their holdings it’s no longer difficult to summarize actual specimen counts. Most large collections are very far from being close to having complete databases or accurate counts of their specimens, so this issue is likely of only theoretical interest to most curators. Additionally, and for good reason, digitization efforts have been largely retrospective—focused on digitization of historical specimens already identified to species. Bulk samples of mixed taxa are of much lower value for such digitization efforts so will be largely ignored for some time. I think it will be of greater interest to curators a few centuries from now when (hopefully!) all collections have been fully digitized. Additionally, since it is most cost-effective to digitize before labeling or identification (at the collection-event stage), once this protocol becomes dominant, the proportion of bulk, mixed-taxon, partially-identified specimens in databases will increase considerably.

Table 1: Some insect collections and their reported sizes. From <http://www.ent.iastate.edu/list/directory/155/vid/4> which includes a larger list.

Collection	Size
Canadian National Collection of Insects	17 million specimens
Carnegie Museum of Natural History	6.9 million specimens
E.H. Strickland Entomological Museum	1 million specimens
Essig Museum of Entomology	4.5 million specimens
Illinois Natural History Survey	6 million specimens
Lincoln University Entomology Research Museum	150,000 specimens
Louisiana State Arthropod Museum	400,000 specimens

A brief tangent to describe this protocol might be valuable. I will use a USFWS project as an example. In 2013 USFWS field biologists ran 17 Malaise traps in two National Wildlife Refuges in Alaska. They contracted with the University of Alaska Museum Insect Collection to process these samples. Each of the 17 bottles of specimens was made into a record in our database and habitat-photos of the traps uploaded, each was identified as 'Arthropoda' (e.g. <http://arctos.database.museum/guid/UAM:Ento:299152>). Each bottle in turn is emptied (or subsampled) and the specimens mounted and counted. A barcode label is made ready for each specimen and these are used in Arctos to 'clone by barcode' which creates clones from the original record for every barcode. So for example, the one bottle then becomes 577 records in Arctos (for 1616 specimens, many are in vials). 577 data labels are then printed from the database and placed on the specimens. All at this point are still identified as 'Arthropoda.' Once labeled they are sorted to higher taxon and then identified as low as possible. Each taxon group is then scanned (all the barcodes are scanned to find the database records for that group) and the database records are updated to the new identification. This is a much more cost-effective method of databasing than trying to enter 577 records after they've been identified (especially if multiple collection events have been intermixed). We estimate three minutes to database per record, so entering 577 records after they have been labeled would take 29 hours (compared to three minutes for entering before they have been labeled).

A spider collection is stored by species-collection-events. So each vial contains specimen(s) of one species from one collection event and each vial gets one record in a database. These species-collection-events are valuable biological data of themselves and so reporting a database/vial count for such a collection is typical and valuable. Spider collections are usually reported as a count of vials, not specimens-equivalent-to-vials, which is nicely unambiguous! Pinned specimens are not species-collection-events. One event might result in dozens or hundreds of pinned

specimens so combining a count of vials and pinned specimens as a total count for a collection does not represent the number of species-collection-events but only a count of objects.

The issue that pushes the complexity of the traditional use of the term 'specimens' too far, in my mind, is that of mixed taxon containers. If a collection has a significant number of containers with more than one identified taxon per container (as we do) then the use of the term 'specimens' as a proxy for collection objects becomes even more problematic. In these cases these counts are no longer of specimens or containers—they become counts of taxon-collection-events.

Some might argue that mixed taxon containers are a bad idea in general, and I would have to agree. Ideally, with infinite resources, these would be parsed out into single taxon containers. Unfortunately, resources are finite, and choices must be made. These mixed taxon containers are of lower research value because of the difficulty in accessing the contained taxa of interest, but they are not of such low value as to be worth discarding. If they are databased then one's database record count will not equal a count of specimens nor a count of containers. Such records are combined in our database with pinned specimen records (which are not taxon-collection-events) so the total database record count is of specimens + taxon-collection-events.

The University of Alaska Museum Insect Collection currently (27 Feb 2015) has an estimated 1,212,007 specimens represented by 219,446 records in our database. It's actually rather hard to obtain a count of collection objects (the things that can bear unique identifiers such as vials) from Arctos. We put barcodes on all containers (including pins) and to get this count we would need to determine how many unique barcodes we have in Arctos—a search that currently is not pre-programmed into Arctos (but a value I can obtain with some effort).

A reporter recently asked me what percent of the UAM Insect Collection did the ~100,000 butterflies of the Kenelm Philip collection represent? I first thought, "Well, we have

200,000 specimens without Ken's collection so the butterflies would be about  $\frac{1}{3}$  the total." But then I remembered that this comparison is apples to oranges (100k specimens vs 200k records)! So I corrected the number based on our total of 1M specimens and said the butterflies represent about  $\frac{1}{10}$  the total. This is just one of many possible examples of confusion that can result from imprecise use of the term 'specimens.'

Note that I reported the 1.2 million as 'estimated'—this is because for some (but not all!) projects, we make rough estimates of the number of specimens inside vials with hundreds of specimens (eg. Collembola or mites) and enter a guess of 100 or 300 etc. These estimates are more accurate than entering a value of 1 but not terribly precise. For some projects, such as a current Alaska Department of Fish and Game study of habitat quality for Olivesided Flycatchers, we estimate the contents of vials with greater precision using a gridded petri dish subsampling/extrapolation approach. These vials, sometimes packed with many hundreds of microlepidoptera, are estimated with much greater precision than most of our vials because we need reliable numbers to estimate biomass. For this project there are 138 vial records identified as Lepidoptera in Arctos for 32,985 specimens.

Some might argue that reporting specimen numbers rather than specimen/lots counts is a form of "padding one's numbers" to inflate the size of one's collection. I think this argument is more likely to be made by those who do not know how many specimens are in their collection or those who have a small discrepancy between their specimen and record counts. If the number of specimens in your collection is known, and the number of database records is significantly different from that count, as is the number of collection objects, I think any curator in that position would find it advantageous to report all of these values separately. If someone asks me how many specimens are in the University of Alaska Museum Insect Collection I am not going to tell them how many database records we have, I am going to tell them how many specimens we have. If some collections start reporting specimen counts in the strict sense and others report them as 'specimen/lots' while others report only database record counts we end up with an apples compared to oranges problem that can only be resolved by more precise language and agreed upon definitions.

Why would one want to know how many specimens are in all those vials? There are any number of reasons—assessing rarity or commonness of a species, comparison of trap methods, or habitat types, wanting to know how many are available for DNA extraction or stable isotope study, wanting to know the sex ratios of species of spiders, etc. Entomology collections have not been databasing their specimens for very long and generally use database systems that were designed for mammals, birds, or plants where every database record usually equals a specimen. It's easy and

tempting to equate the two for entomology collections but ultimately, confusing.

The first place to improve our language is in our databases. GBIF reports a count of 'occurrences' rather than specimens because they include a lot of observation (non-specimen) data. Arctos reports each record as a 'specimen.' iDigBio's webpage reports that they are sharing "26,047,853 specimen records." These are records about specimens and can be called 'specimen records' only in the loose (and more traditional) sense that each record represents one or more specimens. This is not a count of how many specimens are digitized and available for research (or for answering questions like those posed above). The addition of the term 'records' at least makes it clear what is being counted—database records about specimens and not actual specimens. I think a useful approach would be to do as iDigBio has done and use the term 'specimen record' when referring to database records about specimens, and 'specimens' or 'collection objects' (e.g. vials) when referring to a physical collection. It will be up to each curator to decide whether to report only one, or all of these for their collection but hopefully we will all know what is meant.

It would be most unambiguous to report, as many collections already do, the number of pinned specimens, the number of specimens inside vials, the number of vials, the number of specimens inside envelopes and the number of envelopes, etc. and a count of database records. Additionally, it could be informative to break these out into those that are identified to genus or lower versus those that aren't. If one needs a single number to quantify the growth and size of a collection, the specimen record seems like a good one, but I need to resist the temptation to call these a count of specimens.

Recently one of my lab technicians, Megan McHugh, posted proudly on Facebook "Arctos says that I have prepared 5,986 specimens that have been databased for the University of Alaska Museum of the North. That is pretty impressive if I don't say so myself!" I searched and she had actually prepared (handled, counted, sorted) 43,839 specimens represented by those 5,986 records in Arctos; 5,271 of these specimens are pinned, and 38,566 of these specimens are in 713 vials (sorted to order).

## Acknowledgements

I thank various curators and collections managers with whom I've discussed this issue including those who commented on my 10 Dec 2014 post to the ECN-L email list-serv entitled "database records vs specimen records": Andrew Short, Mike Ferro, John Oswald, Dimitri Forero, Barry O'Connor, Sandra Brantley, Gareth Powell, Doug Yanega, Michael Wall, Andrew Brower, Rob Emeroy, Peter Oboyski, Neil Stanley Cobb, Steffi Ickert-Bond, and Paula Cushing.



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# Moths land on Murkowski's desk—Senate Resolution 70

by Kathryn Daly<sup>1</sup>



Figure 1: Moth week 2014, Fairbanks, Alaska. Left to right: Kath Daly (UAF), Nolan Rappa (UAF) and Jim Kruse (USFS, UAF). Photo taken by D. Sikes using the Theodolite iPhone app, shortly after midnight. Background: 175 watt mercury vapor lamp on a camera tripod over a sheet.

In January, Dr. Derek Sikes was contacted by Dave Moskowitz, co-founder of National Moth Week, to ask for help in gaining Alaskan Senator Lisa Murkowski's support for Senate Resolution 70. This resolution would officially designate the last full week of July as "National Moth Week" to focus attention on moths through citizen science. The resolution was introduced in 2013 by Senator Menendez of New Jersey, but it failed to pass because it lacked a Republican co-sponsor.

The primary goal of National Moth Week is to increase knowledge of moth distribution and ecology. It is

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a non-partisan event that people living anywhere can enjoy; moths are found in cities and also in the most remote, wild landscapes. There are over 11,000 moth species known to exist in the United States, but basic distribution and life history information is largely unknown for the majority of these species. National Moth Week was created in 2005 when public moth nights were held through the Friends of the East Brunswick Environmental Commission in New Jersey. Over the past ten years, the initiative has grown quickly. Last year, people across the globe and in all 50 states held National Moth Week events!



To celebrate National Moth Week, people attract moths through the use of lights and/or bait. People can choose to host events where they collect or just photograph moths. After the event, participants are encouraged to upload their photos or species lists to internet sites. These sites include Moth Photographers Group, Butterflies and Moths of North America, Project Noah, BugGuide, and Discover Life. Submissions are screened to ensure accuracy, and they remain available for public examination.

Dave had seen an article about the curation of the late Dr. Ken Philip's Arctic Lepidoptera collection at the University of Alaska Museum. Dr. Philip avidly supported National Moth Week each year by collecting specimens and had also served as one of the National Moth Week Science Advisory board members. He had intended to contact Senator Murkowski himself to ask for her support for this resolution but sadly, Dr. Philip died before this could be done. Dave suggested that perhaps Senator Murkowski would be interested in co-sponsoring SR-70 in honor of Dr. Philip and his phenomenal work with Alaskan Lepidoptera.

It would be a fitting commemoration. In 1970, he founded the Alaska Lepidoptera Survey to organize volunteers across the state to collect butterflies and moths for him. He obtained grants to purchase all the needed supplies to send to anyone who was interested, along with instructions on how to collect these insects in a responsible, scientifically useful manner. He ended up orchestrating over 600 diverse volunteers to collect for him, including Alaskan Native villagers, pipeline workers, children, retirees, and even researchers conducting field work in remote locations. Through this effort, he was able to document the presence

of hundreds of species of moths in Alaska. He was one of the authors on the "Checklist of the Moths of Alaska" (Ferris et al., 2012), which lists 710 known species of Alaskan moths. He recognized that in order to gain an accurate understanding of the diversity of Lepidoptera in Alaska, it was essential to find engaged citizens to help him.

A letter to Senator Murkowski was drafted by myself and Dr. Sikes where we highlighted the importance of moths within ecosystems, the need for citizen science initiatives, and described Dr. Philip's Alaska Lepidoptera Survey. We also extended an invitation for her to tour Dr. Philip's collection at the Museum, if she should have the time and interest when next she visits Fairbanks. I emailed the letter to her office and received a response from her legislative correspondent. He encouraged me to place a call to his office to speak more about the issue. I called to speak with him and was pleased to find that he had already talked briefly with Senator Murkowski about this resolution. He told me that they had both been previously unaware of National Moth Week, but that she felt it was a useful and interesting resolution, and that she would "give this matter the consideration it deserves." He said he would contact me if she decides to support SR-70. I will share any news on this resolution as I learn it!

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## Two new Lepidoptera host plant relationships

by Matt Bowser<sup>1</sup>

### *Clepsis persicana* (Tortricidae) on *Oplopanax horridus* (Araliaceae)

#### Observations

In past summers I had seen curious patterns of damage on leaves of devil's club (Araliaceae: *Oplopanax horridus* (Sm.) Miq.) in the woods around the headquarters building of the Kenai National Wildlife Refuge in Soldotna. There were repeated, symmetrical patterns of holes on the leaves reminiscent of patterns in paper snowflakes (Figures 1-2). Something had apparently been eating holes in the leaf buds, the leaves of devil's club having a pleated, radial pattern

of folding (ptyxis) similar to paper snowflakes. Unfortunately, by the time the patterns were apparent, the artists were long-gone.

As I harvested new buds of devil's club last May for stir-frying, making ranch dip, etc., I came across many small, green caterpillars that were feeding on them (Figures 3-4). Later, as the leaves unfolded, the larvae could be found on the dorsal surfaces of the leaves near the petioles (Figure 5).

I collected some of the caterpillars and kept them alive on developing devil's club leaves in petri dishes, the petioles cut cleanly and wrapped in dampened paper towels to keep the leaves alive and fresh.

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Figure 1: Damage to leaf of devil's club, May 19, 2014.



Figure 3: Caterpillar on bud of devil's club, May 14, 2014.



Figure 2: Damage to leaf of devil's club, May 19, 2014.



Figure 4: Caterpillar on bud of devil's club, May 14, 2014.





Figure 5: Caterpillar on leaf of devil's club, May 19, 2014.



Figure 6: Adult *C. persicana* (KNWR:Ento:10489), May 28, 2014. Original image: <http://arctos.database.museum/media/10436177>

After two weeks, the caterpillars had eclosed. Jim Kruse identified them as *Clepsia persicana* (Fitch, 1856) (Tortricidae), the White Triangle Tortrix, based on a photograph (Figure 6).

Specimens records: USA: Alaska: Soldotna. Ski Hill Road, vicinity of Kenai National Wildlife Refuge headquarters building, just down the hill to the southeast, 60.46376°N, 151.07401°W ±100m. 14 May 2014. Matt

Bowser. Caterpillar collected from developing bud of *Oplonanax horridus*. (KNWR:Ento:10489); 19 May 2014. Matt Bowser. Caterpillar collected from developing bud of *Oplonanax horridus*. (KNWR:Ento:10490, KNWR:Ento:10491, KNWR:Ento:10492).

## Discussion

Among the Lepidoptera, *Agonopterix rosaciliella* (Busck, 1904) (Elachistidae) is the only other species that is known to feed on *O. horridus*; its other hosts are in the family Apiaceae (Robinson et al., 2015). *Agonopterix rosaciliella* is present in Alaska from west-central Alaska eastward (Ferris et al., 2012).

*C. persicana* is a widely polyphagous moth with at least 50 other hosts in 23 plant families, listed below with references. This is the first record of *C. persicana* feeding on a member of the Araliaceae.

### Aceraceae

*Acer negundo* (Gilligan and Epstein, 2015)

### Apiaceae

*Osmorhiza berteroi* (Gilligan and Epstein, 2015)

### Araceae

*Syngonium angustatum* (Robinson et al., 2015)

### Asparagaceae

*Maianthemum canadense* (Gilligan and Epstein, 2015)

### Asteraceae

*Aster* (Robinson et al., 2015)

*Bellis perennis* (Robinson et al., 2015)

*Solidago* (Gilligan and Epstein, 2015)

*Taraxacum officinale* (Robinson et al., 2015)

### Betulaceae

*Alnus incana* (Gilligan and Epstein, 2015)

*Alnus viridis* (Gilligan and Epstein, 2015)

*Betula nana* (Gilligan and Epstein, 2015)

*Betula papyrifera* (Gilligan and Epstein, 2015)

*Corylus* (Gilligan and Epstein, 2015)

*Ostrya virginiana* (Robinson et al., 2015)

### Brassicaceae

*Raphanus* (Robinson et al., 2015)

### Cornaceae

*Cornus canadensis* (Gilligan and Epstein, 2015)

### Ericaceae

*Rhododendron canadense* (Gilligan and Epstein, 2015)

*Vaccinium* (Gilligan and Epstein, 2015)

#### **Fabaceae**

*Trifolium* (Robinson et al., 2015)

#### **Fagaceae**

*Fagus grandifolia* (Robinson et al., 2015)

#### **Gentianaceae**

*Frasera fastigiata* (Gilligan and Epstein, 2015)

#### **Grossulariaceae**

*Ribes* (Gilligan and Epstein, 2015)

#### **Myrtaceae**

*Comptonia peregrina* (Gilligan and Epstein, 2015)

#### **Oleaceae**

*Fraxinus* (Gilligan and Epstein, 2015)

#### **Pinaceae**

*Abies balsamea* (Gilligan and Epstein, 2015)

*Abies concolor* (Gilligan and Epstein, 2015)

*Abies lasiocarpa* (Gilligan and Epstein, 2015)

*Larix laricina* (Robinson et al., 2015)

*Larix occidentalis* (Gilligan and Epstein, 2015)

*Picea engelmannii* (Gilligan and Epstein, 2015)

*Picea glauca* (Gilligan and Epstein, 2015)

*Pinus banksiana* (Gilligan and Epstein, 2015)

*Pseudotsuga menziesii* (Gilligan and Epstein, 2015)

#### **Poaceae**

*Elymus repens* (Robinson et al., 2015)

*Phleum pratense* (Robinson et al., 2015)

#### **Polygonaceae**

*Polygonum* (Robinson et al., 2015)

*Rumex acetosella* (Robinson et al., 2015)

#### **Ranunculaceae**

*Ranunculus* (Robinson et al., 2015)

#### **Rhamnaceae**

*Ceanothus* (Gilligan and Epstein, 2015)

#### **Rosaceae**

*Amelanchier alnifolia* (Robinson et al., 2015)

*Fragaria* (Robinson et al., 2015)

*Malus pumila* (Gilligan and Epstein, 2015)

*Prunus persica* (Gilligan and Epstein, 2015)

*Prunus virginiana* (Gilligan and Epstein, 2015)

*Rosa* (Gilligan and Epstein, 2015)

*Rubus* (Gilligan and Epstein, 2015)

#### **Salicaceae**

*Populus balsamifera* (Gilligan and Epstein, 2015)

*Populus tremuloides* (Gilligan and Epstein, 2015)

*Salix* (Gilligan and Epstein, 2015)

#### **Ulmaceae**

*Ulmus* (Gilligan and Epstein, 2015)

## ***Amblyptilia pica* (Pterophoridae) on *Comarum palustre* (Rosaceae)**

### **Observations**

On July 14, around the edge of Headquarters Lake in Soldotna, I observed a number of larvae feeding on inflorescences of *Comarum palustre* L. The larvae had eaten holes through the bases of the sepals (Figure 7). Some larvae could be found inside of the inflorescence between the sepals and the seeds where they fed on seeds while being concealed by the sepals (Figure 8). Other larvae remained on the stem of the plant, boring holes through the sepals and reaching their heads through the holes to get at the seeds. The caterpillars chewed through the seed coat and ate out the contents.



Figure 7: Holes in sepals of *C. palustre*.

I brought a handful of infested inflorescences into the laboratory and placed this in a plastic container. By July 29, one adult had eclosed (Figure 9). Two more eclosed by August 8. Adults were sent to Deborah Matthews, who determined that they were *Amblyptilia pica* (Walsingham, 1880), the Geranium Plume Moth.

Specimen records: USA: Alaska: Soldotna, Headquarters Lake, floatplane dock, 60.462265°N, 151.074852°W



±15m. 17 Jul 2014. Matt Bowser. On fruits of *Comarum palustre*. (KNWR:Ento:10638, KNWR:Ento:10642, KNWR:Ento:10643).



Figure 8: *A. pica* larva consuming a seed of *C. palustre*.



Figure 9: Adult *A. pica* (KNWR:Ento:10638). Original image: <http://arctos.database.museum/media/10441795>.

## Discussion

*Amblyptilia pica* is a widely polyphagous pterophorid feeding on at least 34 species of plants in 13 plant families, listed below. Most of its hosts are in the Orobanchaceae in genera placed until recently in the Scrophulariaceae. On *Castilleja* and *Pedicularis*, *A. pica* is a seed specialist (Menges et al., 1986; Adler, 2002; Matthews and Lott, 2005), consuming

seeds and other floral parts, consistent with the observed behavior on *C. palustre*.

### Asteraceae

*Calendula* (Matthews and Lott, 2005)  
*Cynara scolymus* (Matthews and Lott, 2005)  
*Eriophyllum confertiflorum* (Matthews and Lott, 2005)  
*Silybum* (Robinson et al., 2015)

### Boraginaceae

*Phacelia imbricata* (Matthews and Lott, 2005)

### Caprifoliaceae

*Lonicera involucrata* (Robinson et al., 2015)

### Fabaceae

*Trifolium* (Matthews and Lott, 2005)

### Geraniaceae

*Geranium* (Matthews and Lott, 2005)  
*Pelargonium hortosum* (Matthews and Lott, 2005)

### Lamiaceae

*Mentha* (Matthews and Lott, 2005)  
*Stachys bullata* (Matthews and Lott, 2005)  
*Stachys chamissonis* (Matthews and Lott, 2005)  
*Stachys palustris* (Matthews and Lott, 2005)

### Orobanchaceae

*Castilleja affinis* (Matthews and Lott, 2005)  
*Castilleja angustifolia* (Matthews and Lott, 2005)  
*Castilleja hispida* (Matthews and Lott, 2005)  
*Castilleja integra* (Matthews and Lott, 2005)  
*Castilleja latifolia* (Matthews and Lott, 2005)  
*Castilleja linariifolia* (Matthews and Lott, 2005)  
*Castilleja lutescens* (Matthews and Lott, 2005)  
*Castilleja miniata* (Adler, 2002; Matthews and Lott, 2005)  
*Castilleja rhexifolia* (Matthews and Lott, 2005)  
*Castilleja sessiliflora* (Matthews and Lott, 2005)  
*Castilleja sulphurea* (Matthews and Lott, 2005)  
*Pedicularis bracteosa* (Matthews and Lott, 2005)  
*Pedicularis furbishiae* (Menges et al., 1986; Matthews and Lott, 2005)

### Phrymaceae

*Mimulus* (Matthews and Lott, 2005)

### Plantaginaceae

*Antirrhinum* (Matthews and Lott, 2005)  
*Penstemon virens* (Matthews and Lott, 2005)  
*Penstemon whippleanus* (Matthews and Lott, 2005)

**Primulaceae***Dodecatheon meadia* (Matthews and Lott, 2005)**Ranunculaceae***Aquilegia* (Matthews and Lott, 2005)**Rosaceae***Prunus emarginata* (Matthews and Lott, 2005)**Scrophulariaceae***Scrophularia californica* (Matthews and Lott, 2005)**Acknowledgments**

I thank Jim Kruse and Deborah Matthews for identifying the moths. Deborah Matthews also provided helpful comments to improve this article.

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## The DNA barcoding UAMU Project: Testing the insect identification power of DNA barcoding technology

by Sarah Meierotto<sup>1</sup> and Derek S. Sikes<sup>1</sup>

In 2014 the University of Alaska Museum Insect Collection (UAM) had funds from the Alaska Department of Fish and Game to pay for identifications. We used this opportunity to compare two methods of identification—traditional versus DNA barcoding. The goal was to maximize the number of specimens identified to species level. Because UAM had funds from the United States Fish and Wildlife Service Alaska Region NWRS Inventory and Monitoring Initiative to build a DNA barcode library of non-marine arthropods for Alaska we thought we'd see how useful the library currently is. At the time of this work we had loaded the DNA Barcode of Life Database (BOLD) with DNA barcodes for over 1,000 species of Alaskan non-marine arthropods. This is about 1/8th of the total state fauna, and because this library is intermixed with the full complement of all DNA barcodes available in BOLD, much of which is of Canadian species that also occur in Alaska, we expected the number of species available for identification-matching to be greater than the ~1,000 we had submitted. Thus, we expected, *a*

*priori*, to obtain species level matches for more than 1/8th of the species represented by the specimens we submitted.

SM, the first author, was given responsibility for managing the workflow of specimen tissue submission to the Canadian Centre for DNA Barcoding (CCDB) in Guelph, Ontario, and for interpretation of the results obtained. SM gained valuable experience using molecular methods in entomology and wrote a procedure for the interpretation of DNA barcode results. We were able to improve the identification of over half of the specimens in the project and more IDs will be possible as the DNA barcode library grows. However, at this stage, DNA barcoding is not a cost effective method of insect identification, but looks promising for the future.

The purpose of the University of Alaska Museum Insect Collection Unidentifieds (UAMU) project was to make use of the BOLD barcode library as an identification resource and to test its precision and cost

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effectiveness. Legs were pulled from 950 unidentified specimens: 60% Hymenoptera, 20% Diptera, and 20% Coleoptera. These specimen records can be accessed via this URL: <http://arctos.database.museum/project/uamu-dna-barcode-project>. A summary of all taxa/identifications of these records is available at this URL <http://arctos.database.museum/saved/DNA-Barcode-UAMU-taxa>. Ten microplates containing 95 legs each were submitted to the CCDB. A summary of the methods follows.

1. **Specimen selection.** The process of identification through DNA barcoding begins with the same raw material as traditional morphological identification at the Museum: a fully curated insect specimen. This refers to a specimen that has been mounted, databased in Arctos, and labeled with collection information. Care is taken to ensure the specimens will be associated with their DNA sequence. The 95 specimens chosen for each plate submission were placed in a grid mirroring the position of their leg in the microplate (Figure 1). Tables of the specimen information and identification numbers were uploaded to BOLD.

2. **Photography.** Each specimen was photographed at the highest magnification possible to fit the insect in the frame (Figure 2). The photos were uploaded to BOLD. Having photographs associated with the DNA sequences allows for quick quality control. Possible contamination is easy to spot when the photo of a specimen shows a bumblebee, but the sequence matches a beetle. Photos also allow for the comparison of obvious morphological characters and make the data more friendly and useful to the public.

3. **Sampling.** Following CCDB protocols, one leg from each of the specimens in the grid was pulled and placed in a microplate. These legs were destroyed to obtain the DNA sample while a quality museum specimen was preserved as a voucher. This preservation allows for supporting morphological comparisons to be made after the DNA based identification is completed.

4. **Sequencing.** The completed plates were mailed to the CCDB where the samples were processed and sequenced. Eventually, the sequence information was uploaded to BOLD by personnel at CCDB where it can be analyzed.



Figure 1: Specimens in grid and empty microplate.





Figure 2: Example of specimen photographed prior to sampling for DNA barcoding. Specimen record: UAM:Ento:145767. Original image: <http://arctos.database.museum/media/10436441>.

5. **Analysis.** The returned sequences were compared to the thousands in BOLD. The BOLD website can calculate percent match to different taxa levels, give a list of previously identified specimens with the closest match, and generate neighbor-joining trees, along with a slew of other functions to help researchers interpret their sequence results. SM made judgment calls on the quality of the BOLD identification matches. There are multiple reasons a match may not be strong or unique. There are still many species that have not been added to the BOLD library (only 156,845 formally described animal species have DNA barcodes, which is just 7.8% of the total ~2 million described animal species) and the number and quality of identified sequences has to be taken into account. It is possible misidentified specimens were submitted to the library or more than one species share the same DNA barcodes (these species might be good biological species, or taxonomic errors that should be synonymized). Sometimes species can be eliminated by comparing known geographical ranges (no identifications of Alaskan specimens were accepted unless that species is already known from Alaska or is known to occur in a region close to Alaska). Some specimens were only possible to identify to family or genus level.

Out of the 950 specimens submitted, 601 yielded long enough sequences to be considered DNA barcodes (Table 1). SM was able to assign a confident species level iden-

tification to 161 of these. There was a fairly large difference between orders in the success of identification. Of the Diptera, 32% were identified to species, while only 14% of the Hymenoptera and 6% of the Coleoptera could be identified at that level. This is not to say that 94% of the Coleoptera sequences were garbage; 22% of beetle IDs were improved, many to genus level. The Diptera yielded many more successful barcodes than the other two orders, possibly somewhat due to a larger average body size and leg size of the specimen submitted. The extremely small beetles and parasitoid wasps seemed to sequence poorly. Some specimens, especially the Ichneumonoid Hymenoptera had many matches in BOLD, but the matches themselves were only identified to family or morpho-species. Barcodes that were not assigned identifications from any of the orders could be matched to species in the future as the barcode library grows. It is possible that eventually all 601 specimens that yielded barcodes will receive species-level identifications via their DNA barcodes, although we are curious how long this will take.

**Costs.** To DNA barcode the 10 microplates of the UAMU project cost \$10,713, or about \$11 per specimen. The total cost divided by the number of species-level identifications (161) comes to \$71 each. Last year, the cost for the Museum to have taxonomists perform identifications by traditional morphological methods averaged \$1 per specimen (Table 2). These costs covered such things as lab technician salary for genitalia microdissections, specialist time, and travel. It should be added, none of the taxonomists charged for all their operational costs, which reduces the cost per specimen. However, it should also be noted that most taxonomists perform identifications gratis, taking only data and sometimes a few specimens in exchange for their efforts. Thus, this average cost of \$1 per traditionally identified specimen is likely higher than the average across all specimens loaned to specialists for identification by UAM. As technology improves and more identified specimens are added to the barcode library, costs of identification with DNA barcoding will drop. Meier et al. (2015) describe a next-generation sequencing (NGS) DNA barcoding approach that costs \$1 per specimen—if such technology could replace the current system in place at CCDB, and if the DNA barcode library contained a much greater representation of species, DNA barcoding would likely be of comparable effectiveness to traditional approaches. To conclude, with current technology and costs, we recommend DNA barcoding to obtain identifications for specimens that cannot be identified in other ways such as damaged specimens (e.g. gut contents of fish or birds), immatures, species that can only be identified by one sex, and specimens in taxa without an available taxonomist.



Table 1: Summary of UAMU results. One Hemiptera specimen was mistakenly sent in as a Hymenoptera specimen. It yielded a confident species level ID.

	Total	Coleoptera	Hymenoptera	Diptera
<b>Specimens sent</b>	950	190	569	190
<b>Barcodes</b>	601	82	338	181
<b>Any sequence</b>	664	91	388	188
<b>ID improvement</b>	562	43	353	165
<b>Confident species IDs</b>	161	13	85	62
<b>% conf spp IDs of sent</b>	16.95	6.84	14.96	32.46
<b>% conf spp IDs of barcoded</b>	26.79	15.85	25.15	34.25
<b>Questionable species IDs</b>	68	13	40	15
<b>Confident genus IDs</b>	247	42	122	83
<b>Questionable genus IDs</b>	18	7	11	0
<b>Subfamily IDs</b>	14	0	14	0
<b>Confident family IDs</b>	128	4	98	26
<b>Questionable family IDs</b>	19	0	17	2

Table 2: Cost of traditional identifications (\$19,972 total).

Taxa	Specialist	Specimens	Species level identifications
Aleocharinae	Jan Klimaszewski	1,872	1,783
Araneae	Jozef Slowik	21,994	16,649
Staphylinidae	Newton & Thayer	3,830	1,157
<b>Total</b>		<b>27,696</b>	<b>19,544</b>

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We thank the Alaska Department of Fish and Game for funding the UAMU project and we thank the United States Fish and Wildlife Alaska Region NWRS Inventory and Monitoring Initiative who funded the building of the DNA barcode library (project UAMIC in BOLD). We also thank the taxonomists who performed the traditional identifications, Jan Klimaszewski, Jozef Slowik, Al Newton, and Margaret Thayer. We thank the collectors and lab technicians who obtained and prepared the specimens: K. Blejwas,

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# Review of the eighth annual meeting

by Matt Bowser<sup>1</sup>



Figure 1: Members present at the end of the meeting. Back row, from left: Robin Andrews, Kathryn Daly, Steve Swenson, Elizabeth Graham, Garret Dubois, Nick Lisuzzo, and Derek Sikes. Front row, from left: Jill Stockbridge, Logan Mullen, Roger Burnside, and Matt Bowser

The eighth annual meeting of the Alaska Entomological Society took place at the Alaska Department of Natural Resources building in Fairbanks on January 24, 2015. We are grateful to Nick Lisuzzo for making this space available.

To me, Ken Philip's passing last spring overshadowed the entire time around the meeting. Whether it was at Derek Sikes' lab at UAM, at the evening get-together on Friday night, or at the meeting, conversations frequently turned to Ken's massive collection, Kathryn Daly's work on curating it, the future of the Alaska Lepidoptera Survey, Ken's legacy, and the man himself. I never knew him well, so I enjoyed learning much more about Ken through looking at his collections, photographs, sound equipment, etc. and by talking about him with Derek and Kathryn. I missed Ken's annual Lepidoptera report, his humor, and his presence at the meeting.

## Presentations

The Lepidoptera theme was reinforced by two related talks. In her presentation, "Alaska Lepidoptera Club," **Kathryn Daly** showed us her work caring for and cataloging Ken

Philip's collection. She has established the Alaska Lepidoptera Club to carry on the work of Ken's Alaska Lepidoptera Survey through a volunteer network. **Greg Breed** spoke about "Analysis challenges in citizen science data," specifically illustrating the usefulness of these kinds of data for examining changing distributions of butterflies.

**Elizabeth Graham**, in her talk entitled "Evaluation of lure and trap design to survey for longhorned beetles in Southeast Alaska," described her continuing work on developing optimized traps for detection of exotic longhorned beetles in the challenging, wet environment of Southeast.

After his presentation, "*Nicrophorus vespilloides* (Coleoptera: Silphidae): One species or two?," **Derek Sikes** had us convinced that there are two species based on genetics, morphology, ecology, and reproductive incompatibility.

I was excited to share my talk, "We're getting there: a first look at (cheap!) next-generation barcoding of bulked arthropod samples." This stimulated conversation on the relative merits, problems, and possible applications of this technology.

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**Robin Andrews** presented a poster on her work with Roger Ruess, "Microarthropod abundance and community structure across a boreal forest riparian chronosequence in Interior Alaska."

The student talks were all excellent this year, including Kathryn Daly's, **Molly McDermott's** "Patterns of terrestrial insect diversity on the Seward Peninsula and notes on an *Elenchus* sp. (Strepsiptera: Elenchidae) host interaction," and **Logan Mullen's** "A preliminary phylogeny of the rove beetle genus *Phlaeopterus* (Coleoptera: Staphylinidae: Omaliinae)," making the job of the student presentation award committee especially difficult. **Alexandria Wenninger** received the award for her presentation, "Hymenoptera assemblages in aspen-dominated and black spruce-dominated post-fire successional trajectories in boreal black spruce forest of interior Alaska," which she delivered with exceptional purpose and clarity. All of these talks described works in progress, so I am excited to see the products of these students' work in the coming years.

## Business Items—Highlights

- It was decided to move management of the Forest Service's Alaska entomology collections to Arctos.
- Derek Sikes announced that a portion of the Kenelm Winslow Philip Entomology fund, an endowment established by the Philip family in Ken's honor and administered by the University of Alaska Foundation for help with the Museum collection and miscellaneous items, will be allocated for a student award. A committee of AKES members was selected to develop the specifics of the award.
- In support of the Alaska Lepidoptera Club recently initiated by Kathryn Daly, we opted to provide a sub-domain and web space for the club. This site is now up and running at <http://aklepclub.akentsoc.org>.
- We discussed simplifying membership categories and changing the fee schedule for AKES membership. On February 10, Derek Sikes sent out a special resolution to change membership categories, posted on the AkEntoNet-L e-mail list (<https://lists.uaf.edu:8025/mailman/listinfo/akentonet-1>).
- Election results: Matt Bowser (president), Logan Mullen (vice president), Jill Stockbridge (secretary), and Roger Burnside (treasurer).

The minutes from the business meeting are available on our website.

