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Counting butterflies

by Luise Woelflein[1]

Figure 1: Science Center intern, Jack Austin, carefully transfers the butterfly he caught with a net into a collecting jar during the 2013 butterfly count. Photo by Hannah Brewster, BLM Campbell Creek Science Center.

If you're around the BLM Campbell Creek Science Center on a warm sunny day in late June or early July, you may catch sight of people walking—and sporadically sprinting!—around, armed with butterfly nets. Each year for the past 15 years, Science Center staff have been joined by butterfly enthusiasts from the community—including, over the years, staff from the UAF Cooperative Extension Service, Eagle River Nature Center, and the National Weather Service—to conduct an official "4th of July Butterfly Count." Sponsored by the North American Butterfly Association (NABA), 4th of July Counts happen each year across the United States and collect information about the distribution and relative population sizes of butterflies. One-day counts also take place in Canada (1st of July Count) and Mexico (16th of September Count). In recent years NABA has begun including seasonal counts in the U.S. and Mexico as well. The 4th of July butterfly count has been happening for 39 years.

Figure 2: Austin gets a closeup look at what he caught. Photo by Hannah Brewster.

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Figure 3: A *Coenonympha tullia* rests after being released during the 2011 butterfly count. Photos by Sherry Bottoms, UAF Cooperative Extension Service.

The count, organized by Science Center staff, takes place within a 15-mile diameter circle centered on the Science Center. The count focuses on the BLM Campbell Tract, adjacent Heritage Land Bank land, and the alpine environment of nearby Chugach State Park's Glen Alps trailhead. During the 2013 count, conducted on June 25th, the survey group counted 30 individuals of 7 different species (*Pieris napi*, *Colias philodice*, *Glaucopsyche lygdamus*, *Plebejus saepiolus*, *Vacciniina optilete*, *Coenonympha tullia*, and *Carterocephalus palaemon*). They also found 14 *Aglais milberti* caterpillars crawling on stinging nettle.

The butterfly count is always weather dependent and no tentative date has yet been set for the 2014 count. If you would be interested in participating in the 2014 count, please contact Luise Woelflein at the BLM Campbell Creek Science Center (`lwoelfle@blm.gov`). To learn more about the Science Center, please visit `http://www.blm.gov/ak/sciencecenter`.

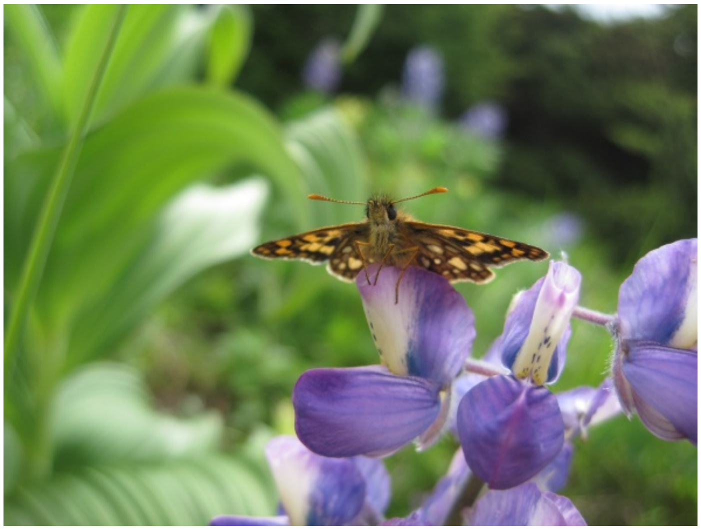

Figure 4: A *Carterocephalus palaemon* rests after being released. Photo by Sherry Bottoms.

Permanent plot network in southeast Alaska investigates shore pine damage agents

by Robin Mulvey[1]

When U.S. Forest Service Forest Inventory and Analysis (FIA) plot remeasurements detected a significant loss of shore pine (*Pinus contorta* subsp. *contorta*) biomass in Alaska (Barrett and Christensen, 2011), it highlighted a critical gap in our knowledge about the insect, disease, and other damage agents of this non-commercial tree. Shore pine is a distinct subspecies of lodgepole pine that occurs from northern California to Yakutat Bay in southeast Alaska. In Alaska, shore pine is a dominant tree in peatland bogs and fens (muskegs), where it faces limited competition from other tree species due to saturated, nutrient-poor soils. It also occurs as a minor component of mixed-conifer stands. Shore pine mortality revealed by the FIA network prompted a two-year project investigating causes of shore pine mortality and dieback. Detection of biomass loss that has not been recognized through other monitoring activities (e.g., Aerial Detection Survey) is an important application of the FIA plot network. This was a unique opportunity to gather baseline information about the insects, pathogens, and other damage agents affecting an understudied tree and forest type (Figures 1-2).

Forty-six permanent plots were installed at five locations in southeast Alaska (Figure 3) using an adapted FIA plot layout. Size and damage information was collected from nearly 5,500 trees ≥ 4.5 ft. tall. Among these were 2,504 live shore pine, 361 dead shore pine, and more than 1,000 trees ≥ 5 in. diameter at breast height (dbh). The dataset gathered from this plot network represents a snap-

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shot of shore pine's current condition; over time, it will provide valuable information about mortality rates and trends, and the types of damage most often associated with tree mortality.

Figure 1: Forested wetland dominated by shore pine on Wrangell Island. Note the person in the center for scale.

Figure 2: Forested wetland dominated by shore pine on northeast Chichagof Island.

We found that a higher proportion of shore pine (13%) and yellow-cedar (14%) trees were dead compared to other associated conifers, and that snags were most common among the largest diameter pines (40% of trees >15 in.d̃bh were snags). Western gall rust, bole wounds, root exposure, and Dothistroma needle blight were the most common forms of damage to live shore pine.

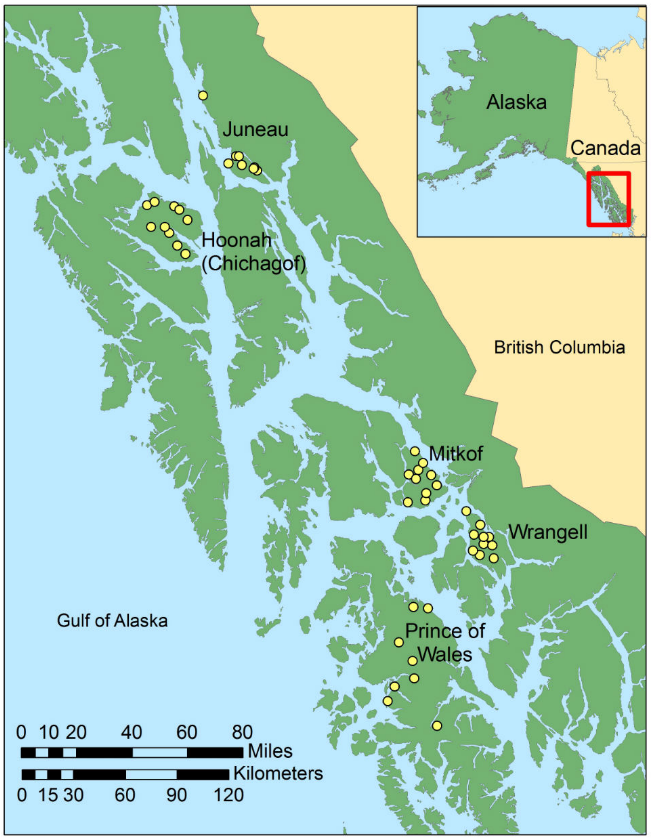

Figure 3: Forty-six permanent plots were established to monitor shore pine across five locations in southeast Alaska in 2012 and 2013.

Western gall rust, caused by the fungus *Peridermium harknessii*, infected 85% of live shore pine and at least half the pines in every plot. This fungus causes spherical swellings on the branches and boles of 2- and 3-needle pines. Bole galls are more damaging to the tree crown than branch galls, because gall-associated girdling kills all tissue beyond the gall. Over one-third of shore pine had galls on the main bole, and one-fourth had topkill associated with bole galls. There was a strong relationship between the presence and number of bole galls and percent crown dieback. On average, shore pine with bole galls in the top, middle, and lower portions of the live crown had 50% crown dieback.

In some locations, there was pronounced recent mortality of gall-infected boles and branches (Figure 4). Nearly 300 galls from recently-killed branches were collected in and around our plot network to identify secondary causes of girdling. Key culprits included the fungus *Nectria cinnabarina*, caterpillars (Lepidoptera: Pyralidae: *Dioryctria*) (Figure 5), bark beetles (Coleoptera: Curculionidae: Scolytinae: *Pseudips mexicanus*), and twig beetles (Coleoptera: Curculionidae: Scolytinae: *Pityophthorus*).

Figure 4: Abundant mortality of western gall rust-infected boles and branches. Bole galls can be seen on the three dead leaders of the pine pictured front-right. Topkill associated with western gall rust significantly contributed to shore pine crown dieback.

Figure 5: Removing the bark from a western gall rust bole gall revealed galleries and frass of *Dyoryctria* caterpillars. These galleries had girdled the stem, killing the top of the tree.

Almost half of all live shore pine had some kind of wound. The most common wounds were damage to the bole from a variety of causes, or poor root anchorage in standing water, saturated soils, or mossy mounds. The severity of wounds and the proportion of live shore pine wounded increased with tree diameter. Porcupine feeding, antler rub, bear scratch, frost cracks, burls, and fungal cankers (Figure 6) all contributed to bole wounding, but often the specific cause could not be determined. Bole wounds were substantially more common among shore pine (32% of live trees) compared to associated species (2-8%). Poor root anchorage was the most common wound for non-pines, but probably only harms trees when severe. It appears that many associated conifers regenerate best in the muskeg on elevated mounds, microsites that they may outgrow over time.

Figure 6: A canker-like bole wound on shore pine. Work is underway to determine if a fungal pathogen is responsible for this type of wound. Bole wounds from various causes were very common on shore pine, but rarely observed on associated conifers.

Dothistroma needle blight, caused by the fungus *Dothistroma septosporum*, was widespread and common in our plot network. This disease, in addition to other factors, is thought to limit foliage retention of shore pine across the study area. On average, shore pine retained just over 3 needle cohorts, which makes it sensitive to consecutive years of severe foliage disease. Wet, mild weather conditions during the growing season are conducive to disease development. Dothistroma needle blight was not severe enough to cause mortality in study plots, but has stressed and killed pines in Gustavus and nearby Glacier Bay National Park in recent years. Other less damaging foliar pathogens detected from shore pine were *Lophodermium seditiosum* and *Lophodermella concolor*, causes of Lophodermium and Lophodermella needle casts. Needle injury from lodgepole needle miner (*Coleotechnites milleri*) was suspected, but larvae were not found and telltale circular exit holes near needle tips were rarely observed. However, outbreaks of this internal leaf-feeding insect have occurred in southeast Alaska. Lodgepole pine sawfly (*Neodiprion nanulus contortae*) had never been reported here, but was widespread in our plot network (13 of 46 plots, all locations except Juneau) and is presumed to be native (Graham and Mulvey, 2013). Sawfly defoliation was usually restricted to a few scattered branches, but some small trees were heavily defoliated. Defoliating weevils in the genera *Magdalis* or *Scythropus* may also damage shore pine, but this tentative identification is solely based on photographs of the feeding damage and remains to be verified.

It was not possible to conclusively document the causes of mortality of snags, since evidence is lost as snags deteriorate. However, secondary and tertiary beetles and galleries and fungal stain were observed on some large dying and recently-killed pines. Detected bark beetles included *Pseudips mexicanus*, *Dendroctonus murryanae*, *Dryocoetes* sp., and the ambrosia beetle *Trypodendron lineatum*. We hypothesize that accumulated stress from bole wounds, western gall rust (and secondary gall invaders), foliage diseases, and harsh site conditions may kill shore pine directly or attract secondary bark beetles to weakened, larger trees. Despite the high incidence of damage, shore pine is regenerating in study plots. At this time, biotic damage agents of shore pine in southeast Alaska are believed to be native, although new state records were found and more work is needed to verify the causes of some forms of damage (e.g., bole cankers and wounds). Further trapping, rearing, and identification work may help us to report more insect pests of shore pine previously undocumented in Alaska. The plot network will be monitored every 5 years to provide information on shore pine damage and survival. Shore pine is a remarkably resilient tree, and we hope that this work generates more interest in this unique forest type.

For more information about this project, please contact Robin Mulvey at `rlmulvey@fs.fed.us`.

Acknowledgements

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References

Barrett, T. M., and G. A. Christensen, 2011. Forests of southeast and south-central Alaska, 2004-2008: five-year forest inventory and analysis report. General Technical Report PNW-GTR-835, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon. URL `http://www.fs.fed.us/pnw/pubs/pnw_gtr835.pdf`.

Graham, E., and R. Mulvey. 2013. A new state record, *Neodiprion nanulus contortae* Ross collected from shore pine in southeast Alaska. Newsletter of the Alaska Entomological Society **6**:1–3. URL `http://www.akentsoc.org/doc/AKES_newsletter_2013_I.pdf`.

Regional inventory of terrestrial arthropods: comparison of two malaise trap samples from Kanuti National Wildlife Refuge, Alaska, processed by the University of Alaska Museum Insect Collection

by Derek S. Sikes[1]*, Logan Mullen*[2]*, and Casey Bickford*[3]

Abstract

Two Malaise trap samples taken in Kanuti National Wildlife Refuge, one in 2010 run for 8 days and one in 2013 run for 3 days, are compared with a focus on museum processing costs in time and materials. The 2010 sample was identified to lowest taxon (i.e. various unidentified species could exist within a genus-level or family-level identification) whereas the 2013 sample was identified to morphospecies (or species in some cases).

The 2010 sample took 135 hours to process and had 1582 specimens (11.7 specimens processed /hr) needing 1,145 pins and 7 vials. These specimens represented 70 unique identifications (~minimum number of species) within 36 families, obtained during the past three years.

The 2013 sample took 320 hours to process and had 1,215-1,615 specimens (5 specimens processed /hr) needing 475 pins and 99 vials. These specimens represented 210 species or morphospecies, within 32 families, identified in the past four months.

Biologically the samples were similar in having mostly Diptera with Hymenoptera being the second most abundant order, with these orders together accounting for 93% and 95% of each sample. Few specimens, or singletons, were present of Acari, Lepidoptera, Odonata, Thysanoptera, Hemiptera, Araneae, Psocoptera, and Trichoptera. Hemiptera represented 3% of the 2010 sample but, oddly, none of the 2013 sample. Coleoptera represented 1% of the 2013 sample but none of the 2010 sample. We conclude that sorting the 2013 sample to morphospecies is likely the primary explanation for why the 2013 sample took more time per specimen to process.

Introduction

Malaise traps are highly efficient means of capturing large numbers of flying insects, primarily flies and wasps. As part of a project for the National Wildlife Refuge System Inventory and Monitoring Initiative, during 2013, Malaise trap samples were taken by USFWS personnel in two Alaskan National Wildlife Refuges: Kanuti and Tetlin. Between 1 January and 7 May 2014 one trap sample from Kanuti was processed in the University of Alaska Museum Insect Collection by LM. In 2010 a similar Malaise trap sample was taken in Kanuti and processed by CB between ~1 September 2010 and 2 November 2010. This report will compare these two samples biologically and from a laboratory resource management perspective focusing on the cost in time and materials used. It is hoped that by doing so this report will become a useful reference for planning future survey projects and provide a glimpse into Alaskan arthropod hyperdiversity.

Methods

Field 2010

Between 9-16 July 2010 USFWS personnel ran a Malaise trap in Kanuti National Wildlife Refuge at 66.32548°N, 152.28565°W which was described as a "riparian, wet meadow" (Figure 1A).

Field 2013

Between 21-23 June 2013 USFWS personnel ran a Malaise trap in Kanuti National Wildlife Refuge at 66.43870°N, 151.29974°W which was described as "*Eriophorum* tussock shrubby wetland" (Figure 1B, Figure 2).

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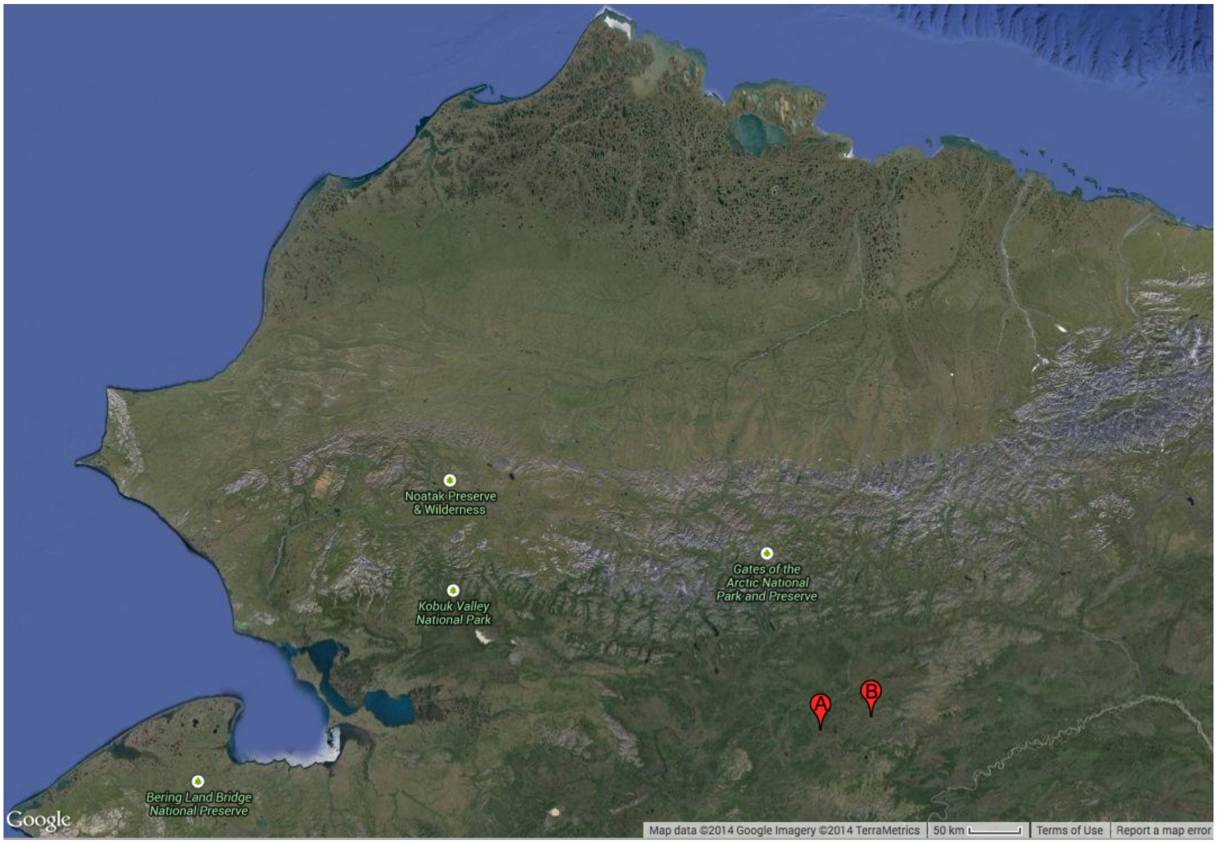

Figure 1: Map of northwestern Alaska showing the location of the two Malaise trap samples in Kanuti National Wildlife Refuge. A: 2010 sample, B: 2013 sample.

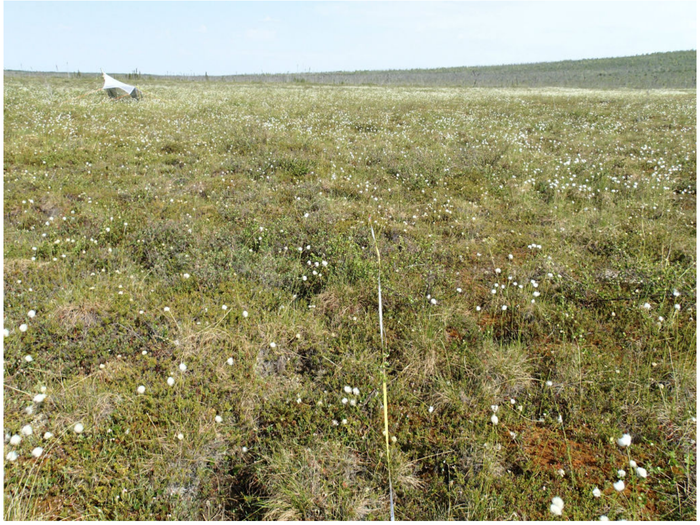

Figure 2: Site of the 2013 sample. The full resolution image is available at `http://dx.doi.org/10.7299/X7862GK0`.

Lab 2010

Specimens were pinned, or pointed using stainless steel #3 pins, or stored in 70% ethanol in glass 1-dram vials. All pinned specimens or vials were given unique 2D matrix barcode labels and databased. The database was used to print data/locality labels. These were printed on archival BioQuip© label paper using an HP laser printer and toasted at 300°F to bond the ink deeper into the paper. Labels were placed on pins under specimens or in vials. Specimens were then identified by CB to lowest taxon, usually family-level. These and all subsequent identifications were updated in the database by scanning the barcodes of the specimens receiving an identification to find and update their records. During the ensuing 3 years these specimens were borrowed by specialists who were able to refine many of the identifications to genus or in some cases, species.

Lab 2013

Processing was identical to 2010 with the exception that specimens were identified to morphospecies by LM. This involved comparing every specimen within a higher taxon (e.g. a family) to each other and grouping them by presumed species based on observable, external morphological differences such as size, color pattern, etc. Additionally, the bulk sample was handled differently than in 2010. A project and accession was first made in the database Arctos. The 500 ml nalgene bottle with the Malaise trap sample stored in pure propylene glycol was given a barcode label and entered as a single catalog record. This record was later cloned into the 574 database records representing the pinned/pointed specimens and vials. To improve the "DNA-friendliness" of the processing, the bulk sample was stored in a -20°C freezer until it was ready to be processed. These data are available as saved searches via Arctos at `http://arctos.database.museum/saved/collecting_event_10295126` (2010) and `http://arctos.database.museum/saved/collecting_event_10656599` (2013) or may be searched via the UAM Insect Collection portal at `http://dx.doi.org/doi:10.7299/X75D8S0H`.

Results

2010

Between ~1 September 2010 and 2 November 2010 CB processed the 2010 sample. This required 135 hours and yielded 1,582 specimens needing 1,145 pins and 7 vials. These represented 70 unique identifications (~minimum number of species) within 36 families, obtained during the past three years (Table 1). This rate of processing equates to 11.7 specimens per hour across the entire 135 hours. Note that a strict comparison is difficult because not all identifications currently available for specimens of this sample were obtained during the 135 processing hours. Many were provided by specialists after CB had stopped working with the sample.

2013

LM processed the 2013 sample between 1 Jan 2014 and 6 May 2014 using a total of 320 hours. The sample contained 1,215-1,615 specimens. At least four morphospecies were too numerous to count and were estimated at 100 specimens each as a close approximation. A total of 99 vials and 475 pinned specimens were prepared. This rate of processing equates to 5 specimens per hour across the entire 320 hours.

Species richness was high with 210 morphospecies or species identified within 32 families. Abundance within species was low with an average of 2.8 specimens per morphospecies or species. Only 5 morphospecies had more than 20 individuals (Table 1).

As is typical of Malaise trap samples, both had mostly Diptera (87% [2010] and 84% [2013] percent by specimens) with Hymenoptera being the second most abundant order (6% and 11%). These two orders together accounted for 93% [2010] and 95% [2013] of each sample. Few specimens, or singletons, were present of Acari, Lepidoptera, Odonata, Thysanoptera, Hemiptera, Araneae, Psocoptera, and Trichoptera. Hemiptera represented 3% of the 2010 sample, due, in part, to 46 specimens of Cicadellidae but, oddly, none of the 2013 sample. Coleoptera represented 1% of the 2013 sample but none of the 2010 sample.

Table 1: Counts of specimens per identified species / morphospecies / lowest taxon, of two Malaise trap samples from Kanuti NWR, Alaska. Note that morphospecies numbering is non-consecutive. Catalog numbers are hyperlinked to corresponding Arctos specimen records.

Taxon	2010	2013	UAM:Ento Catalog Numbers
Arthropoda	-	1	271443
Arachnida			
Acari	7	-	138033
Acari sp.01	-	18	271282
Acari sp.02	-	1	271283
Acari sp.03	-	3	271284
Araneae			
Dictynidae	1	-	138034
Insecta	18	-	138037
Coleoptera			
Cantharidae			
Cantharidae sp.01	-	4	270279, 270332, 270417, 271285
Cantharidae sp.02	-	4	270293, 270302, 270376, 270377
Elateridae			
Elateridae sp.01	-	3	270378, 270403, 270415
Elateridae sp.02	-	2	270289, 270334
Lampyridae			

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Taxon	2010	2013	UAM:Ento Catalog Numbers
Ellychnia sp.	-	1	270369
Staphylindae			
Staphylinidae sp.01	-	1	270444
Staphylinidae sp.02	-	1	270308
Diptera	116	-	138036, 146484, 146492, 146501, 146503, 146506, 146509, 146511, 146514, 146515, 146516, 146517, 146518, 146520, 146521, 146522, 146523
Diptera sp.01	-	1	271279
Diptera sp.02	-	1	271278
Brachycera	-	3	270287, 270352, 270409
Anthomyiidae	92	-	139424, 140103, 140106, 140130, 140131, 140132, 140133, 140134, 140135, 140136, 140137, 140138, 140175, 140176, 140177, 140179, 140180, 140182, 140183, 140184, 140185, 140186, 140187, 140188, 140190, 140191, 140192, 140193, 140194, 140195, 140196, 140298, 140299, 140300, 140301, 140302, 140303, 140304, 140305, 140306, 140307, 140308, 140309, 140310, 140311, 140312, 140323, 140324, 140325, 140326, 140327, 140328, 140465, 140466, 140467, 140468, 140469, 140470, 140471, 140472, 140473, 140474, 140475, 140476, 140477, 140478, 140479, 140480, 140481, 140483, 140484, 140509, 140511, 140903, 140904, 140948, 140949, 140950, 141064, 141066, 141326, 141327, 141328, 143264, 143265, 143266, 143267, 143268, 143435, 143436, 143437, 143438
Pegomya tabida	2	-	140433
Zaphne ambigua	2	-	140123, 140126
Anthomyiidae sp.01	-	1	260114
Anthomyiidae sp.02	-	4	260095, 260110, 260185, 260205
Anthomyiidae sp.03	-	1	260123
Anthomyiidae sp.04	-	5	259942, 259944, 259950, 260082, 260167
Anthomyiidae sp.05	-	1	260199
Anthomyiidae sp.06	-	3	259979, 260061, 260117
Anthomyiidae sp.07	-	1	260075
Anthomyiidae sp.08	-	5	260032, 260057, 260087, 260091, 260180
Anthomyiidae sp.09	-	5	259988, 260112, 260119, 260179, 260197
Anthomyiidae sp.10	-	1	260189
Anthomyiidae sp.11	-	1	260052
Anthomyiidae sp.12	-	4	259915, 260016, 260072, 260100
Anthomyiidae sp.13	-	1	260090
Anthomyiidae sp.14	-	1	260060
Calliphoridae	1	-	146535
Acronesia sp.	2	-	146534, 146536
Lucilia illustris	5	-	146528, 146530, 146531, 146532, 146533
Phaenicia sp.	1	-	146529
Chloropidae	9	-	143592, 143595, 143596, 146479, 146483, 146488, 146498, 146499, 146513
Dolichopodidae	34	-	138711, 138712, 138713, 138714, 138715, 138716, 138717, 138718, 138719, 138720, 138721, 138722, 138723, 138724, 138725, 138726, 138727, 138728, 138729, 138730, 138731, 138732, 138733, 138734, 138735, 138736, 139841, 139842, 139843, 139844, 139845, 139846, 139847, 140482
Dolichopodidae sp.01	-	6	260017, 260046, 260050, 260193, 260207, 270294
Dolichopodidae sp.02	-	1	260005
Drosophilidae	5	-	143610, 143611, 146476, 146510, 146519

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Taxon	**2010**	**2013**	**UAM:Ento Catalog Numbers**
Empididae	4	-	146486, 146487, 146504, 146512
Empididae sp.01	-	40	270284, 270290, 270291, 270379, 270385, 270426, 270445, 271267
Empididae sp.02	-	5	270301, 270304, 270333, 270405, 270418
Empididae sp.03	-	10	270288, 270311, 270353, 270364, 270365, 270383, 270389, 270401, 270425, 270429
Empididae sp.04	-	1	270434
Ephydridae			
Ephydridae sp.01	-	21	260036, 270280, 270286, 270299, 270331, 270336, 270338, 270339, 270342, 270344, 270345, 270361, 270363, 270394, 270395, 270396, 270411, 270413, 270432, 270436, 270437
Ephydridae sp.02	-	24	270277, 270281, 270282, 270324, 270326, 270327, 270357, 270359, 270374, 270380, 270382, 270386, 270397, 270399, 270400, 270406, 270408, 270414, 270421, 270423, 270424, 270433, 270439, 270441
Fanniidae	843	-	See Table 2
Fanniidae sp.01	-	10	259926, 259943, 259946, 259949, 259997, 260001, 260104, 260148, 260188, 260204
Fanniidae sp.02	-	1	270384
Fanniidae sp.03	-	1	270375
Fanniidae sp.05	-	28	259911, 259912, 259927, 259954, 259959, 259986, 259994, 260015, 260033, 260037, 260038, 260039, 260048, 260054, 260076, 260077, 260078, 260086, 260098, 260103, 260106, 260146, 260149, 260151, 260153, 260169, 260178, 260191
Heleomyzidae	2	-	140319, 140320
Heleomyzidae sp.01	-	2	270350, 270427
Lonchaeidae ?	-	2	270381, 270446
Muscidae	101	-	139436, 139440, 140105, 140110, 140111, 140112, 140113, 140114, 140115, 140116, 140117, 140118, 140120, 140121, 140122, 140124, 140125, 140127, 140293, 140294, 140295, 140296, 140329, 140330, 140331, 140332, 140333, 140334, 140335, 140336, 140337, 140338, 140340, 140341, 140342, 140343, 140344, 140434, 140435, 140436, 140437, 140438, 140439, 140440, 140441, 140442, 140443, 140444, 140445, 140446, 140447, 140448, 140449, 140450, 140505, 140506, 140507, 140508, 140902, 140952, 140953, 140954, 140955, 140956, 141023, 141133, 141134, 141135, 141331, 141332, 141333, 141334, 141335, 141336, 141339, 141340, 142983, 142984, 143253, 143254, 143255, 143256, 143257, 143259, 143260, 143261, 143262, 143263, 143439, 143441, 143442, 143443, 143444, 143445, 143446, 143447, 143451, 143452, 143589, 143590, 143591
Coenosia sp.	1	-	143594
Drymeia sp.	2	-	139432, 139434
Graphomya sp.	2	-	139435, 140109
Lispe sp.	1	-	140119
Mesembrina sp.	8	-	138742, 139425, 139426, 139427, 139428, 139429, 139430, 139431
Phaonia sp.	9	-	139439, 140104, 140108, 140292, 140297, 141337, 141338, 143258, 143440
Polietes sp.	1	-	139433
Spilogona sp.	3	-	139437, 139438, 140107
Muscidae sp.01	-	4	259908, 260011, 260070, 260198
Muscidae sp.02	-	3	259958, 260002, 260085
Muscidae sp.03	-	2	270329, 270356
Muscidae sp.04	-	3	259972, 260068, 260202
Muscidae sp.05	-	4	259909, 259981, 260195, 260200

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Taxon	**2010**	**2013**	**UAM:Ento Catalog Numbers**
Muscidae sp.06	-	6	259996, 260009, 260013, 260040, 260080, 260171
Muscidae sp.07	-	1	259999
Muscidae sp.08	-	1	260041
Muscidae sp.09	-	1	260053
Phoridae	11	-	146480, 146481, 146482, 146489, 146490, 146491, 146495, 146496, 146497, 146500, 146508
Phoridae sp.01	-	128	259917, 259919, 259920, 259928, 259930, 259931, 259933, 259938, 259945, 259956, 259974, 259975, 260055, 260088, 260089, 260092, 260099, 260102, 260107, 260108, 260109, 260111, 260115, 260116, 260118, 260121, 260125, 260187, 271276
Phoridae sp.02	-	34	271277
Pipunculidae	1	15	146524, 271281
Sarcophagidae	5	-	139450, 139451, 139470, 139471, 139472
Brachicoma sp.	1	-	139473
Sarcophagidae sp.01	-	3	259973, 260045, 260059
Sarcophagidae sp.02	-	2	260051, 260066
Sarcophagidae sp.03	-	2	259983, 260101
Sarcophagidae sp.04	-	1	260143
Sarcophagidae sp.05	-	1	260190
Scathophagidae	4	-	140199, 140202, 141065, 141325
Chaetosa sp.	1	-	143612
Cordilura sp.	2	-	139906, 139907
Parallelomma sp.	1	-	143593
Sepsidae	2	-	143608, 143609
Stratiomyidae	1	-	139899
Syrphidae	16	-	138689, 138690, 138699, 138700, 138701, 138702, 138705, 138706, 138709, 138710, 138737, 138738, 138739, 138740, 138741, 140129
Lejops sp.	1	-	138704
Syrphus sp.	31	-	138669, 138670, 138671, 138672, 138673, 138674, 138675, 138676, 138677, 138678, 138679, 138680, 138681, 138682, 138683, 138684, 138685, 138686, 138687, 138688, 138691, 138692, 138693, 138694, 138695, 138696, 138697, 138698, 138703, 138707, 138708
Syrphidae sp.01	-	4	270298, 270325, 270328, 270366
Syrphidae sp.02	-	4	259969, 260028, 260133, 260138
Syrphidae sp.03	-	4	260022, 260027, 260129, 260160
Syrphidae sp.04	-	2	259967, 260019
Syrphidae sp.05	-	1	260136
Syrphidae sp.06	-	1	260024
Syrphidae sp.07	-	1	260132
Syrphidae sp.08	-	2	260124, 260127
Tabanidae			
Chrysops mitis	2	-	146526, 146527
Hybomitra sexfasciata	1	-	138040
Hybomitra sp.01	-	12	259961, 259962, 259963, 259964, 260020, 260021, 260130, 260131, 260137, 260155, 260165, 260272
Hybomitra sp.02	-	18	259965, 259966, 259968, 260023, 260025, 260134, 260139, 260140, 260141, 260142, 260156, 260157, 260158, 260159, 260161, 260162, 260163, 260164
Tabanidae sp.01	-	2	260018, 260030
Tachinidae	14	-	139446, 139447, 139448, 139449, 140128, 140313, 140339, 140432, 140945, 140946, 141329, 141330, 143252, 143448
Thelaira bryanti	5	-	139441, 139442, 139443, 139444, 139445

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Taxon	2010	2013	UAM:Ento Catalog Numbers
Tachinidae sp.01	-	3	260004, 260071, 260194
Tachinidae sp.02	-	2	260034, 260042
Tachinidae sp.03	-	2	260012, 260084
Nematocera			
Nematocera sp.01	-	1	260294
Nematocera sp.02	-	1	260312
Nematocera sp.03	-	1	260291
Nematocera sp.04	-	1	260274
Nematocera sp.05	-	2	260260
Nematocera sp.06	-	1	260266
Nematocera sp.07	-	1	260282
Nematocera sp.08	-	1	260295
Nematocera sp.09	-	2	260277
Nematocera sp.10	-	1	260276
Nematocera sp.11	-	1	260271
Nematocera sp.12	-	1	260283
Nematocera sp.13	-	1	260302
Nematocera sp.14	-	1	260269
Cecidomyiidae			
Cecidomyiidae sp.01	-	1	260284
Cecidomyiidae sp.02	-	2	260263
Cecidomyiidae sp.03	-	1	260285
Cecidomyiidae sp.04	-	17	260289
Cecidomyiidae sp.05	-	5	260280
Cecidomyiidae sp.06	-	43	260264
Cecidomyiidae sp.07	-	2	260293
Cecidomyiidae sp.08	-	11	260262
Ceratopogonidae	2	-	143617, 143618
Ceratopogonidae sp.03	-	1	260216
Ceratopogonidae sp.06	-	6	260221
Ceratopogonidae sp.07	-	14	260223
Ceratopogonidae sp.12	-	1	260213
Ceratopogonidae sp.13	-	6	260214
Ceratopogonidae sp.15	-	1	260237
Ceratopogonidae sp.16	-	36	260228
Ceratopogonidae sp.17	-	1	260210
Ceratopogonidae sp.19	-	12	260308
Ceratopogonidae sp.21	-	1	260265
Ceratopogonidae sp.31	-	2	260297
Ceratopogonidae sp.32	-	4	260275
Ceratopogonidae sp.33	-	1	260249
Ceratopogonidae sp.35	-	1	260219
Ceratopogonidae sp.36	-	1	260267
Ceratopogonidae sp.38	-	2	260270
Ceratopogonidae sp.39	-	2	260309
Ceratopogonidae sp.40	-	23	260273
Chironomidae	6	-	143607, 144688, 144689, 146485, 146494, 146505
Chironomidae sp.01	-	2	260211
Chironomidae sp.03	-	34	260231
Chironomidae sp.04	-	2	260230
Chironomidae sp.05	-	1	260229
Chironomidae sp.06	-	13	260226

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Taxon	2010	2013	UAM:Ento Catalog Numbers
Chironomidae sp.07	-	100	260224
Chironomidae sp.08	-	3	260292
Chironomidae sp.09	-	100	260232
Chironomidae sp.12	-	25	260235
Chironomidae sp.13	-	19	260236
Chironomidae sp.14	-	1	260239
Chironomidae sp.15	-	4	260310
Chironomidae sp.16	-	7	260305
Chironomidae sp.17	-	7	260240
Chironomidae sp.18	-	7	260303
Chironomidae sp.19	-	1	260256
Chironomidae sp.20	-	1	260258
Chironomidae sp.21	-	6	260254
Chironomidae sp.22	-	1	260227
Chironomidae sp.23	-	4	260243
Chironomidae sp.24	-	15	260247
Chironomidae sp.25	-	1	260300
Chironomidae sp.26	-	1	260241
Chironomidae sp.27	-	100	260245
Chironomidae sp.28	-	1	260244
Culicidae	1	-	144687
Culicidae sp.01	-	2	271280
Culicidae sp.02	-	18	260313
Limoniidae			
Metalimnobia solitaria	1	-	144681
Symplecta hybrida	1	-	144685
Mycetophilidae	6	-	143613, 143614, 143615, 143616, 144690, 144691
Mycetophilidae sp.01	-	6	260246
Mycetophilidae sp.02	-	1	260250
Mycetophilidae sp.03	-	100	260252
Mycetophilidae sp.04	-	26	260251
Mycetophilidae sp.05	-	1	260253
Sciaridae	6	-	143619, 143620, 143621, 143622, 143623, 146507
Sciaridae sp.01	-	2	260261
Sciaridae sp.02	-	11	260287
Sciaridae sp.03	-	7	260288
Sciaridae sp.04	-	36	260307
Simuliidae	10	-	143597, 143598, 143599, 143600, 143601, 143602, 143603, 143604, 143605, 143606
Simuliidae sp.01	-	3	260215
Simuliidae sp.02	-	5	260259
Tanyderidae ?	-	1	260304
Tipulidae	4	2	144682, 144683, 144684, 144686, 271268
Hemiptera			
Aphididae	1	-	138038
Cicadellidae	46	-	144707, 144708, 144709, 144710, 144711, 144712, 144713, 144714, 144715, 144716, 144717, 144718, 144719, 144720, 144721, 144722, 144723, 144724, 144725, 144726, 144727, 144728, 144729, 144730, 144731, 144732, 144733, 144734, 144735, 144736, 144737, 144738, 144739, 144740, 144741, 144742, 144743, 144744, 144745, 144746, 144747, 144748, 144749, 144750, 144751, 144752
Cixiidae	1	-	144753

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Taxon	2010	2013	UAM:Ento Catalog Numbers
Hymenoptera			
Apocrita	-	10	270285, 270296, 270323, 270343, 270347, 270387, 270390, 270398, 270402, 270428
Apoidea			
Apidae			
Bombus sp.	-	1	260173
Chalcidoidea			
Chalcidoidea sp.01	-	2	259980, 260113
Chalcidoidea sp.02	-	2	259948, 260168
Chalcidoidea sp.03	-	8	259947, 259982, 260182, 270314, 270362, 270372, 270410, 270430
Chalcidoidea sp.04	-	1	259951
Cynipoidea			
Cynipoidea sp.01	-	1	260031
Charipidae	1	-	144200
Ichneumonoidea			
Braconidae	9	-	144173, 144174, 144193, 144194, 144195, 144196, 144197, 144198, 144199
Braconidae sp.01	-	1	260067
Braconidae sp.02	-	2	259925, 259984
Braconidae sp.03	-	3	259929, 259971, 260079
Braconidae sp.04	-	6	259924, 259941, 259993, 260186, 271594, 271595
Braconidae sp.05	-	1	259976
Ichneumonidae	58	-	143659, 143660, 143661, 143662, 143663, 143664, 143665, 143666, 143667, 143668, 143669, 143670, 143671, 143672, 143673, 143674, 143675, 143676, 143677, 143678, 143679, 143680, 143681, 143682, 144129, 144130, 144132, 144133, 144134, 144135, 144136, 144137, 144138, 144139, 144140, 144141, 144142, 144143, 144144, 144145, 144146, 144147, 144155, 144156, 144157, 144158, 144159, 144160, 144161, 144162, 144163, 144169, 144170, 144171, 144172, 144191, 144192, 144692
Ichneumonidae sp.01	-	6	259921, 259970, 260007, 260145, 260166, 260174
Ichneumonidae sp.02	-	4	259918, 259935, 259990, 260058
Ichneumonidae sp.03	-	5	259907, 259914, 260064, 260154, 260196
Ichneumonidae sp.04	-	1	260014
Ichneumonidae sp.05	-	3	259922, 259989, 260152
Ichneumonidae sp.06	-	1	260172
Ichneumonidae sp.07	-	3	259910, 260093, 260183
Ichneumonidae sp.08	-	1	259985
Ichneumonidae sp.09	-	2	259955, 260203
Ichneumonidae sp. 10	-	6	259978, 259991, 260049, 260065, 260177, 260184
Ichneumonidae sp. 11	-	4	259940, 259998, 260008, 260010
Ichneumonidae sp. 12	-	6	259936, 260056, 260063, 260069, 260120, 260175
Ichneumonidae sp. 13	-	2	259960, 260026
Ichneumonidae sp. 14	-	1	260135
Ichneumonidae sp. 15	-	1	260029
Ichneumonidae sp. 16	-	9	259913, 259987, 259995, 260000, 260094, 260105, 260122, 260144, 260170
Ichneumonidae sp. 17	-	3	260047, 260083, 260147
Ichneumonidae sp. 18	-	1	259923
Ichneumonidae sp. 19	-	2	260035, 260073
Ichneumonidae sp. 21	-	4	259932, 260150, 260181, 260206
Ichneumonidae sp. 22	-	6	259934, 259992, 260006, 260096, 260192, 260201

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Taxon	**2010**	**2013**	**UAM:Ento Catalog Numbers**
Ichneumonidae sp. 23	-	1	260097
Ichneumonidae sp. 24	-	1	259977
Ichneumonidae sp. 25	-	2	259953, 260043
Ichneumonidae sp. 26	-	1	260081
Proctotrupoidea			
Proctotrupoidea sp.01	-	19	270295, 270297, 270300, 270303, 270305, 270306, 270307, 270309, 270310, 270368, 270370, 270371, 270391, 270392, 270420, 270435, 270440, 270442, 270443
Proctotrupoidea sp.02	-	23	270274, 270278, 270292, 270313, 270316, 270318, 270321, 270322, 270335, 270337, 270340, 270346, 270349, 270351, 270355, 270358, 270388, 270393, 270404, 270407, 270412, 270416, 270419
Proctotrupoidea sp.03	-	2	259916, 260176
Proctotrupoidea sp.04	-	2	260062, 260126
Proctotrupoidea sp.05	-	2	260003, 260074
Proctotrupoidea sp.06	-	1	259952
Proctotrupoidea sp.07	-	3	270275, 270341, 270422
Proctotrupoidea sp.08	-	14	270276, 270283, 270312, 270315, 270317, 270320, 270330, 270348, 270354, 270360, 270367, 270373, 270431, 270438
Diapriidae	4	-	144176, 144177, 144178, 144179
Proctotrupidae	1	-	144175
Vespoidea			
Vespidae			
Dolichovespula arenaria	5	-	138645, 138646, 138648, 138649, 138651
Dolichovespula maculata	4	-	138032, 138633, 138634, 138635
Dolichovespula norvegicoides	2	-	138644, 138650
Dolichovespula norwegica	1	-	138643
Vespula acadica	1	-	138647
Vespula rufa	7	1	138636, 138637, 138638, 138639, 138640, 138641, 138642, 259957
Symphyta			
Tenthredinidae			
Tenthredinidae sp.01	-	1	259939
Tenthredinidae sp.02	-	1	260128
Tenthredinidae sp.03	-	1	260044
Tenthredinidae sp.04	-	1	259937
Lepidoptera	23	-	139393, 139395, 139396, 139397, 139398, 139399, 139400, 139401, 139402, 139403, 139404, 139405, 139406, 139407, 139408, 139409, 139410, 144754, 144755, 144756, 144757, 144758, 144759
Lepidoptera sp.01	-	3	271271
Lepidoptera sp.02	-	2	271270
Lepidoptera sp.03	-	1	271269
Lepidoptera sp.04	-	29	271272
Lepidoptera sp.05	-	2	271273
Lepidoptera sp.06	-	1	271274
Lepidoptera sp.07	-	1	271275
Odonata			
Corduliidae			
Cordulia shurtleffii	-	1	270319
Psocoptera	2	-	138039
Thysanoptera	-	1	271286
Trichoptera			
Phryganeidae	8	-	138035
Σ	**1,582**	**1,615**	

Table 2: UAM:Ento catalog numbers of Fanniidae from Kanuti NWR, 2010.

UAM:Ento Catalog Numbers
140314, 140315, 140316, 140317, 140318, 140321, 140322, 140451, 140452, 140453, 140454, 140455, 140456, 140457, 140458, 140459, 140460, 140461, 140462, 140463, 140464, 140485, 140486, 140487, 140512, 140513, 140514, 140515, 140516, 140517, 140518, 140519, 140520, 140521, 140522, 140523, 140524, 140525, 140526, 140527, 140528, 140529, 140530, 140531, 140862, 140863, 140864, 140865, 140866, 140867, 140905, 140908, 140909, 140910, 140911, 140912, 140913, 140914, 140916, 140917, 140918, 140919, 140920, 140933, 140934, 140935, 140936, 140937, 140938, 140939, 140940, 140941, 140942, 140943, 140944, 140947, 140951, 140957, 140958, 140959, 140960, 140961, 140962, 140963, 140964, 140965, 140966, 140967, 140968, 140969, 140970, 140971, 140972, 140973, 140974, 140975, 140976, 140977, 140978, 140979, 140980, 140981, 140982, 140983, 140984, 140985, 140986, 140987, 140988, 140989, 140990, 140991, 140992, 140993, 140994, 140995, 140996, 140997, 140998, 140999, 141000, 141001, 141002, 141003, 141004, 141005, 141006, 141007, 141008, 141009, 141010, 141011, 141012, 141013, 141014, 141015, 141016, 141017, 141018, 141019, 141020, 141021, 141022, 141078, 141079, 141080, 141081, 141082, 141083, 141085, 141086, 141087, 141088, 141089, 141090, 141091, 141092, 141093, 141094, 141095, 141096, 141097, 141098, 141099, 141100, 141101, 141102, 141103, 141104, 141105, 141106, 141107, 141108, 141109, 141110, 141111, 141112, 141113, 141114, 141115, 141116, 141117, 141118, 141119, 141120, 141121, 141122, 141123, 141341, 141342, 141343, 141344, 141345, 141346, 141347, 141348, 141349, 141350, 141351, 141352, 141353, 141354, 141355, 141356, 141357, 141358, 141359, 141360, 141361, 141362, 141363, 141364, 141365, 141366, 141367, 141368, 141369, 141370, 141371, 141372, 141373, 141374, 141375, 141376, 141377, 141378, 141379, 141380, 141381, 141382, 141383, 141384, 141385, 141386, 141387, 141388, 141389, 141390, 141391, 141392, 141393, 141394, 141395, 141396, 141397, 141398, 141399, 141400, 141401, 141402, 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Discussion

There are many differences of both the lab processing methods and the biological data between these two Malaise trap samples. The habitats were likely grossly similar in both being wetlands in Kanuti NWR, but likely different in many important aspects unknown to us. The traps ran for different lengths of time: 8 days versus 3 days. The 2010 sample had 36 families represented and the 2013 sample 32. Nevertheless, it is surprising to us how different the taxonomic composition of each sample is. Although the 2010 sample was sorted to a total of 70 identifications—less than half that of 2013—it is highly likely that among the incompletely identified specimens (e.g. 18 Insecta, 843 Fanniidae, 101 Muscidae, and 116 Diptera) there are many additional species that would bring the total species count above 200.

In conclusion, this comparison of these two samples has shown some of the challenges and alternative ways of sampling biodiversity, most of which lie in identification. This illustrates the often-cited "taxonomic bottleneck" (Kim and Byrne, 2006), which exists even in relatively species-poor regions like Alaska. It would be difficult, but interesting, to record all subsequent hours expended on the refinement of identifications. Such an accounting would likely find that identifications comprise the majority of time spent. One of the major differences in processing, that the 2013 sample was sorted to morphospecies and the 2010 wasn't, likely explains the majority of the longer processing time taken for the 2013 sample, although differences in experience level between LM and CB could also account for some of the difference in time.

DNA barcoding has been touted as a solution to the taxonomic bottleneck (Hebert et al., 2003) and newer, next-generation sequencing methods (metabarcoding) may yet prove cost-effective (Ji et al., 2013). However, current, traditional DNA barcoding, at a cost of about $12 per specimen, would result in an identification cost of $28,800 for the 2010 sample—a factor of 10 greater than it cost to process by morphological identification. Additionally, it is likely that many DNA barcoded specimens would remain unidentified, at least in the short term, due to a current lack of a complete library of identified DNA barcodes for most dipteran and hymenopteran species. We look forward to a future in which species-level identifications of hyperdiverse insect taxa are available for a cost of about $1 per specimen, or less.

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Upcoming Events

Dragonfly Day, June 28, 2014

Join U.S. Fish and Wildlife Service, Friends of Alaska National Wildlife Refuges, and other partners for the 5th annual Dragonfly Day at Chena Lake Recreation Area, Swim Beach Pavillion. Discover Dragonflies in our habitat! Hot Licks Ice Cream “Northern Bluet” special limited flavor! Crafts, face painting, and other fun activities! Contact: Allyssa Morris, (907) 456-0213, `allyssa_morris@fws.gov`.

Fourth of July Butterfly Count, 2014

See the article, page 1.

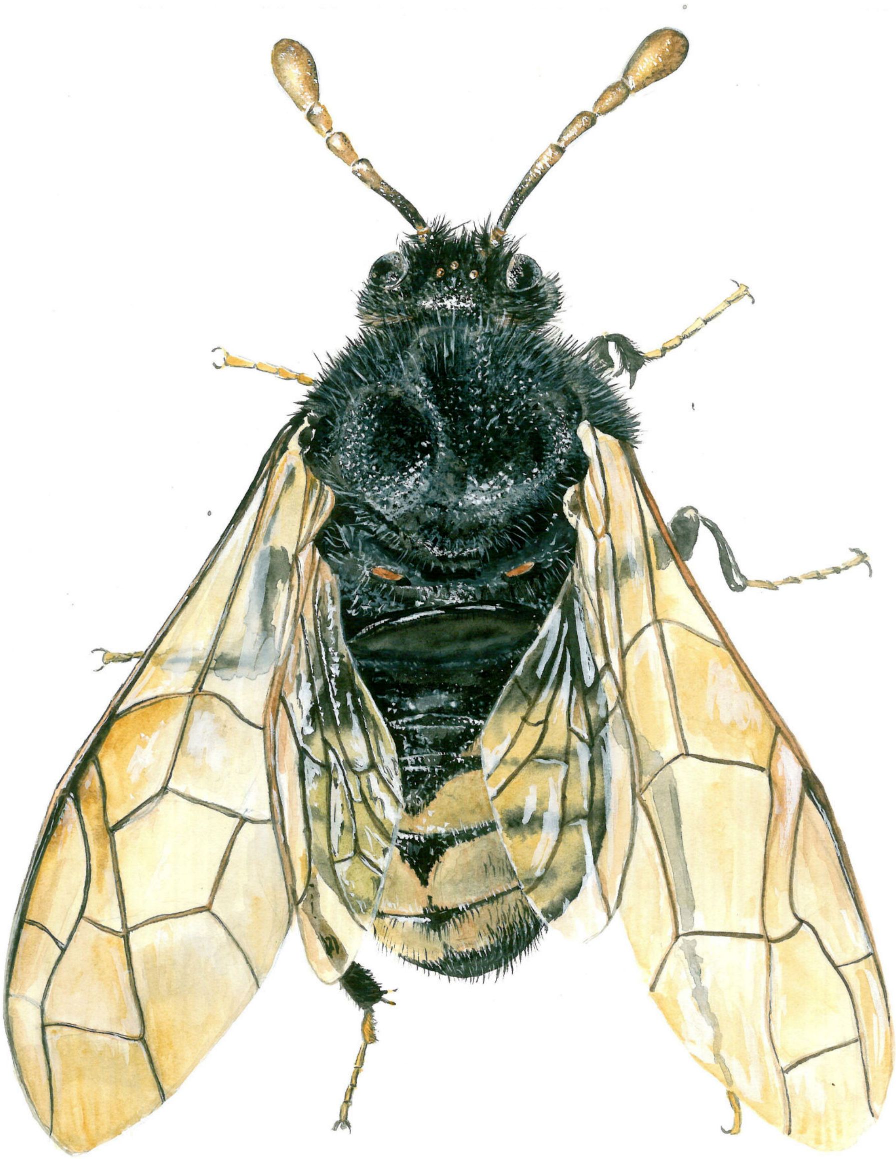
Denali Bioblitz, July 26-29, 2014

Denali National Park and Preserve will be hosting a multi-day bioblitz focused on arthropods from July 26-29, 2014. On Saturday (July 26th), scientists will lead citizen science survey activities in the front-country (i.e., in areas accessible by trails near the park entrance), including demonstrations of collecting techniques, and viewing and discussion of specimens at the park visitor center. The following three days (July 27-29) will be based at the MSLC Field Camp near Teklanika Campground at mile 29 on the park road (with accommodations in tent cabins). This will provide opportunities for a limited number of scientists, students, and other registered participants to collect arthropods in less accessible areas of the park.

Please contact Jessica Rykken at `jrykken@oeb.harvard.edu` if you are interested in participating in the bioblitz as a scientist, student, or other interested entomologist!

Eighth Annual Meeting, January 23-24, 2015

The eighth annual meeting of the Alaska Entomological Society will take place in Fairbanks on January 23-24, 2015. Check for updates on our events page as the meeting date approaches.



Dorsal habitus of *Cimbex americana* specimen UAM:Ento:184870. Watercolor by Dominique Collet. Full resolution scan available at `http://dx.doi.org/10.7299/X7GQ6XWZ`.