Interior Ecosystem: Wild, Living, Arthropod Biodiversity in the University of Alaska Museum

Derek Sikes,[1] Kyle Callegari[2]

[1]University of Alaska Museum, Institute of Arctic Biology, University of Alaska Fairbanks, dssikes@alaska.edu
[2]Department of Biology and Wildlife, University of Alaska Fairbanks, callegarikyle@gmail.com

QUESTIONS

- Which species of arthropods can be found alive inside the University of Alaska Museum?
- What are their diets and trophic roles?
- How diverse is a high-latitude indoor ecosystem?

INTRODUCTION

Synanthropes

Wild species that benefit from association with humans

Characteristics of synanthropic arthropods include:
- Cave-dwelling life history in evolutionary past
- Detritivorous, predatory, or fungivorous (mold feeding) diet

Museums strive to minimize synanthropes
- Pests species can damage museum specimens
- IPM control measures - freezing, cleanliness, vigilance
- Sticky trap monitoring

This investigation will help us better understand this interior ecosystem and help reduce negative impacts on museum collections.

METHODS

Specimens were opportunistically collected alive by museum staff using sticky traps and by hand, inside the University of Alaska Museum (UAM, 64.858°N, 147.842°W) between 2001 – 2019. Many of these have been prepared and added to the museum collection. Collection effort was not controlled and smaller bodied (eg Acari, Collembola), and flying (eg Diptera) organisms were likely undersampled.

Data for these specimens were downloaded from Arctos, the online specimen data management system used by the UAM Insect Collection. http://arctos.database.museum/saved/insideUAM

Species were coded into one of three categories (Fig. 1) using ecological knowledge of each taxon combined with our observed count data. Analysis were conducted using Microsoft Excel.

Indoor Association Scale

1 **True synanthropes** - establish breeding populations indoors
2 **Seasonally abundant inside** – don't establish breeding populations indoors
3 **Transients** - arthropods rarely found indoors

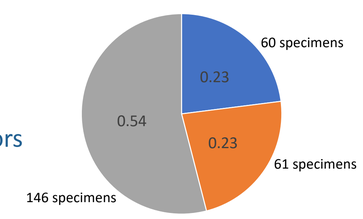

Figure 1. Percentage of arthropod specimens categorized by indoor association.

Table 1. Identification list, specimens counts, and synanthrope association coding.

ORDER	FAMILY	IDENTIFICATION	COUNT	ASSOCIATION
Araneae	Agelenidae	*Agelenopsis utahana*	1	
Araneae	Amaurobiidae	*Arctobius agelenoides*	1	
Araneae	Araneidae	*Araneus marmoreus*	1	
Araneae	Araneidae	*Araneus trifolium*	1	
Araneae	Araneidae	Araneidae	1	
Araneae	Dictynidae	*Phantyna bicornis* ?	1	
Araneae	Linyphiidae	*Erigone arctica*	10	
Araneae	Linyphiidae	Linyphiidae	1	
Araneae	Lycosidae	Lycosidae	9	
Araneae	Lycosidae	*Pardosa* sp.	1	
Araneae	Lycosidae	*Pardosa fuscula*	1	
Araneae	Lycosidae	*Pardosa hyperborea*	1	
Araneae	Oecobiidae	*Oecobius cellariorum*	1	
Araneae	Philodromidae	Philodromidae	1	
Araneae	Salticidae	*Eris militaris*	1	
Araneae	Theridiidae	*Steatoda borealis*	12	
Araneae	Thomisidae	Thomisidae	3	
Araneae	Thomisidae	*Xysticus* sp.	3	
Mesostigmata		Mesostigmata	22	
Coleoptera	Anthicidae	*Anthicus coracinus*	1	
Coleoptera	Buprestidae	*Buprestis nutalli*	2	
Coleoptera	Buprestidae	*Melanophila acuminata*	1	
Coleoptera	Carabidae	*Amara interstitialis*	5	
Coleoptera	Carabidae	*Amara patruelis*	11	
Coleoptera	Carabidae	*Amara* sp.	2	
Coleoptera	Carabidae	*Bembidion grapii*	1	
Coleoptera	Carabidae	*Bembidion obscurellum*	1	
Coleoptera	Carabidae	*Bembidion quadrimaculatum*	1	
Coleoptera	Carabidae	*Bembidion* sp.	3	
Coleoptera	Carabidae	*Calathus ingratus*	1	
Coleoptera	Carabidae	*Carabus chamissonis*	1	
Coleoptera	Carabidae	*Carabus vietinghoffii*	2	
Coleoptera	Carabidae	*Dicheirotrichus cognatus*	2	
Coleoptera	Carabidae	*Platynus decentis*	1	
Coleoptera	Carabidae	*Pterostichus adstrictus*	5	
Coleoptera	Carabidae	*Syntomus americanus*	1	
Coleoptera	Cerambycidae	*Monochamus scutellatus*	1	
Coleoptera	Coccinellidae	*Coccinella transversoguttata*	1	
Coleoptera	Coccinellidae	*Coccinella trifasciata*	1	
Coleoptera	Coccinellidae	Coccinellidae	1	
Coleoptera	Coccinellidae	*Hippodamia parenthesis*	1	
Coleoptera	Cryptophagidae	*Cryptophagus acutangulus*	11	
Coleoptera	Curculionidae	*Otiorhynchus ovatus*	3	
Coleoptera	Dermestidae	*Anthrenus verbasci*	1	
Coleoptera	Dermestidae	*Dermestes lardarius*	2	
Coleoptera	Dermestidae	*Dermestes maculatus*	2	
Coleoptera	Dermestidae	Dermestidae (larvae)	8	
Coleoptera	Dermestidae	*Reesa vespulae*	8	
Coleoptera	Dermestidae	*Trogoderma variabile*	1	
Coleoptera	Dytiscidae	*Colymbetes dahuricus*	1	
Coleoptera	Dytiscidae	*Colymbetes* sp.	1	
Coleoptera	Dytiscidae	*Dytiscus* sp.	1	
Coleoptera	Elateridae	*Danosoma obtectum*	1	
Coleoptera	Latridiidae	*Cartodere constricta*	1	
Coleoptera	Latridiidae	*Corticaria serrata*	7	
Coleoptera	Latridiidae	*Corticaria* sp.	1	
Coleoptera	Latridiidae	*Corticarina minuta*	1	
Coleoptera	Latridiidae	*Dienerella filum*	12	
Coleoptera	Latridiidae	Latridiidae	2	
Coleoptera	Nitidulidae	*Glischrochilus vittatus*	1	
Coleoptera	Ptinidae	*Stegobium paniceum*	2	
Coleoptera	Silphidae	*Aclypea opaca*	7	
Coleoptera	Silphidae	*Thanatophilus sagax*	1	
Coleoptera	Silphidae	*Nicrophorus investigator*	1	
Coleoptera	Silvanidae	*Oryzaephilus surinamensis*	1	
Coleoptera	Staphylinidae	Philonthina	2	
Diptera	Empididae	*Rhamphomyia* sp.	1	
Diptera	Psychodidae	Psychodidae	6	
Diptera	Phoridae	Phoridae	2	
Diptera	Drosophilidae	*Drosophila* sp.	1	
Diptera	Scathophagidae	Scathophagidae	1	
Diptera	Sciaridae	Sciaridae	1	
Hemiptera	Rhyparochromidae	*Peritrechus convivus*	2	
Hymenoptera	Tenthredinidae	*Nematus* sp.	1	
Hymenoptera	Formicidae	*Colobopsis* sp.	2	
Lepidoptera	Noctuidae	*Euxoa ochrogaster*	1	
Lepidoptera	Tineidae	*Tineola bisselliella*	1	
Lepidoptera	Noctuidae	*Ufeus* sp.	3	
Lepidoptera		Gelechioidea	2	
Neuroptera	Chrysopidae	*Chrysoperla* sp.	1	
Opiliones	Phalangiidae	*Phalangium opilio*	1	
Orthoptera	Acrididae	*Melanoplus* sp.	1	
Psocodea	Psyllipsocidae	*Dorypteryx domestica*	20	
Psocodea	Sphaeropsocidae	*Badonnelia* sp.	19	
Zygentoma	Lepismatidae	*Thermobia domestica*	4	

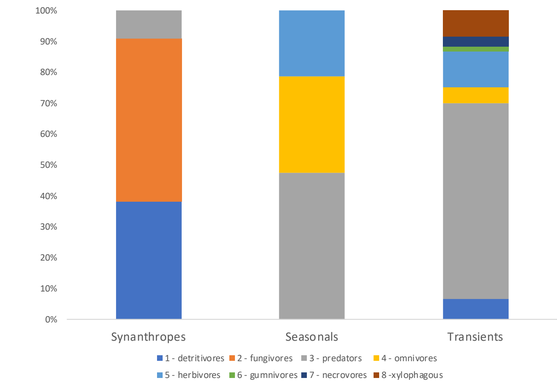

Figure 2. Stacked histogram illustrating the percent diet type of collected arthropods categorized by synanthrope association ranking.

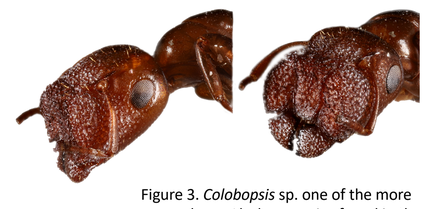

Figure 3. *Colobopsis* sp. one of the more unusual non-Alaskan species found in the museum. Worker ant with a phragmotic (tunnel-blocking) head.

SUMMARY

- A minimum of 73 arthropod species in 44 families and 12 orders have been documented alive inside the museum over 18 years.
- Beetles, spiders, and booklice represented 80% of the total abundance.
- Booklice abundance was far greater than comparable studies (Turner, 1998) (Bertone et al., 2016); likely due to differences in collection methods.
- Synanthropes were primarily fungivores and detritivores; seasonals were primarily predators and omnivores; transients were primarily predators and had the greatest diet diversity (fig. 2).
- Transients had the greatest species diversity (n=41), seasonals the least (n=11), with synanthropes (n=21) in between.
- The most common month for synathrope capture was January, for seasonals was September, and for transients was July.

References

- Balvín O, Munclinger P, Kratochvíl L, Vilímová J. (2012). Mitochondrial DNA and morphology show independent evolutionary histories of bedbug *Cimex lectularius* (Heteroptera: Cimicidae) on bats and humans. Parasitology Research 111:457-469
- Bertone, M. A. et al. (2016). Arthropods of the great indoors: characterizing diversity inside urban and suburban homes. PeerJ 4, e1582
- Martin, L. J. et al. (2015). Evolution of the indoor biome. Trends Ecol. Evol. 30, 223–232.
- Leong, M., Bertone, M. A., Bayless, K. M., Dunn, R. R. & Trautwein, M. D. (2016). Exoskeletons and economics: indoor arthropod diversity increases in affluent neighbourhoods. Biol. Lett. 12, 20160322.
- Leong, M, M.A. Bertone, A.M. Savage, K.M. Bayless, R.R. Dunn, M.D. Trautwein. (2017). The Habitats Humans Provide: Factors affecting the diversity and composition of arthropods in houses. Scientific Reports 7, Article number: 15347.
- Turner BD, Bishop J. (1998). An analysis of the incidence of psocids in domestic kitchens: the PPFA 1997 household survey (What's bugging your kitchen). Environmental Health Journal 106:310-314.

Acknowledgments

We thank the many UAM staff who helped collect specimens: A. Haberski, A. Linn, A. Gunderson, B. Jacobson, B. Paige, C. Coon, C. Bickford, D. David, J. Withrow, J. Williamson, M. Bastiani, M. Wyatt, K. Kvalevog, J. Arseneau, J. Stockbridge, J. Slowik, K.C. May, K. Daly, L. Gangloff, L. Olson, L. Mullen, N. Sikes, P. Druckenmiller, P. Hetman, S. Huguet, S. Meierotto, S. Ridling, and S. Bouta. We also thank the many entomologists, arachnologists, and acarologists who helped identify specimens: A. Cline, A. Haberski, A. Newton, A. Herrmann, B. Sinclair, B. Fleshman, C. Bickford, C. Venables, C. Grinter, C. Ferris, D. Chandler, G. Scudder, G. Anweiler, G. Pelletier, H. Goulet, H. Proctor, J. Acorn, J. Slowik, J. Longino, M. Wyatt, M. Bowser, P. Ward, R. Westcott, R. Davidson, T.K. Philips, T. Macrae, T. Kane, W. Rücker