Conservation Matters: Contributions from the Conservation Committee

How to contribute to conservation by collecting

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My studies of Lepidoptera are contributing to conservation. I've been a moth collector all my adult life. I contribute data to interested organizations. I apply for permits. I submit reports as required, and I defend (sometimes against harsh critics) the need for permits and reporting. I've given talks at the Entomological Society of America, The Lepidopterists' Society, the Entomological Society of Washington, and many more about the value of collecting, permits, and reports. I participate fully with such societies as The Lepidopterists' Society and The Ohio Lepidopterists. Figure 1 (Metzler 2015) is a poster that I presented on behalf of White Sands National Monument at the 2015 "**Science for Parks, Parks for Science: The Next Century" conference** at Berkeley, California that details how my collecting activities have contributed to conservation. In this article I summarize **and further develop key elements** of the poster.I kill hundreds of moths in non-discriminating bucket traps each time I go out. Is this conservation or am I satisfying some need to accumulate as many moths (being a twist on the old adage that the person who dies with the most toys wins) as possible? Am I rationalizing? When I first moved to New Mexico I showed some of my collection to a group of local naturalists, and when one of them, a Ph.D. botanist asked "But why do you have so many of each kind?" I used this teaching moment to remind her that collections (like herbaria) are repositories of data and DNA which would otherwise not be available for future research. She nodded. Had I given a flip off-the-cuff defensive response, this opportunity to explain myself and what many of us do in our Society would have been lost.

Perhaps the time that I felt most defensive was when I was asked about my catch-all traps by the law enforcement officers of the Ohio Department of Natural Resources (ODNR). These were my co-workers, and they were challenging me. They were reluctant to permit me to take samples in sensitive habitats for fear I could do damage to populations of insects that relied on the very habitat that I wanted to sample. They correctly cited examples of plant lovers who trampled wetlands looking for rare plants. In frustration I replied that they'd never know which species of moths they were protecting unless I took samples and reported the results. Point made but game far from won.

I believe the connection between the words "rare" and "endangered" is extremely unfortunate. To elaborate, my good friend and mentor Roy W. Rings was very embarrassed by the outcome produced when he was asked to provide a list of rare moths in Ohio. Roy was well along recording data for his upcoming publication (Rings et al. 1992), so that when asked, he willingly provided a list based on adult specimens held in Ohio's many collections. In most of Ohio's collections, as is usually the case, common cutworm pests, such as *Agrotis ipsilon* (aka black cutworm) adults were poorly represented. Roy, an expert on larvae, did not notice that he was inadvertently including the black cutworm on the list of rare species. Roy knew everything about the black cutworm larvae, yet he'd never collected an adult, and the presence of *A. ipsilon* on his list of supposed rare species escaped his attention. For us moth collectors, we usually always pass over *A. ipsilon* as just another uninteresting species, thus explaining why Roy found so few adults in collections. When the list, with neither Roy's knowledge nor approval, made its way to the U.S. Fish and Wildlife Service (US-FWS), they irresponsibly translated the list from "rare" to "Endangered" moths. You can imagine the reaction from Fred Rindge and others when they saw that the black cutworm was going to be listed as endangered in Ohio. Roy was correctly indignant. It took a lot of back-peddling and finger pointing at the US-FWS to get that misuse of data cleared up. That was the episode that caused me to drop the words "rare" and "collecting" from my vocabulary.

Now I take samples, and some species are infrequently seen at black light – but I do not imply that they are "rare in nature." Just infrequently sampled. In my experience, many so called rare moths became common once I knew where and how to find them. The elusive *Catocala judith* flies well after midnight when most moth collectors are in bed or telling stories around the campfire. *Eupsilia devia*, a seldom seen winter moth, came to bait commonly in Michigan and Ohio, if the bait was applied outside the woods and in an adjacent meadow. At my property in southern Ohio, *Paonias astylus* came to my sheet just as the sun was rising.

It is my opinion that our normal collecting technique, black light, has too often proved to be an inadequate way of determining a species' distribution and relative abundance. For example Eric Quinter showed us that the noctuid *Resapamea trigona* can be common as long as you don't rely on black light to find them. David Wagner's recent paper (2008) about *Lithophane joannis* further demonstrates the point. And I learned that using historical collections to determine how common a species is might be

Collecting Moths leads to New Discoveries, Conservation, and Preservation of Moths

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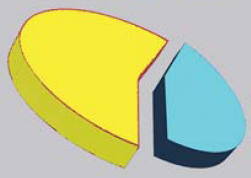
Insects Dominate Complex Life Forms on Earth



Insects outnumber all other Eukarya (plants and animals), combined, on Earth. Insects are greatest in numbers of species, individuals, and combined mass. In the graphic on the left, all of the flora, charismatic, and megafauna are included in the light blue. Whales, wolves, tigers, cheetahs, tropical rain forests, giant redwoods, and you-name-it are in the light blue. If you want to know what is happening on Earth, you have to know what the insects are doing.

Lepidoptera, Butterflies and Moths, is the Second Largest Order of Insects

Approximately 12% of all plants and animals on earth are butterflies or moths. They are extremely numerous. They are a critical part of the web-of-life as consumers, nutrition for other animals, pollinators, and as detritivores. The caterpillars of many species of moths eat senescing or decaying plant materials to aid the process of breaking down vegetation into humus

Baby birds need caterpillars (Al Staffan, Ohio DNR photo)

Butterflies and moths are nature's botanists. 99% of Lepidoptera are herbivores and most are host specific. As habitats change, plant communities change, and the associated species of Lepidoptera become different. The types of habitat and habitat health can be ascertained by studying moths at any particular site (see Shuey et al. 2012) **Why moths?**

Most Lepidoptera are Moths, by a Ratio of Almost 10 to 1

Moths are about 8.5% of all plants and animals. We usually do not to think of moths because they tend to fly only at night when they are not easily seen, and on average they are smaller than most butterflies. Most people respond negatively to moths, yet if we want to investigate the environment, we need to look at moths.

Methods and Materials I collected moths in many locations in Ohio for 32 years. I concentrated my sampling activities in Ohio's sensitive habitats, primarily remnant prairies and wetlands. Moths were collected in USDA bucket-type kill-traps. The moths from each sample were sorted to species and recorded in an Access® database. Most of the smaller moths were dissected to examine internal genital organs for positive identification. In 2007 after I moved to southern New Mexico, I began a 10 year study of moths at White Sands National Monument. I employed the same techniques for the Monument study to take samples of moths and identify the moths. The tool of DNA Barcoding was utilized to screen for undescribed species.

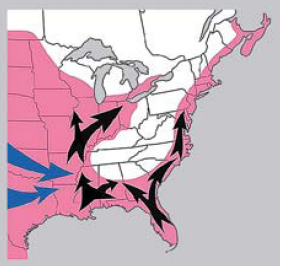
Results In Ohio, prairie and wetland dependent species were recorded and some species were described as new to science (Metzler 2000, Metzler & Sabourin 2002,Metzler & Zebold 1995). The discovery of *Photedes enervata* and *Wakula carneella* in NE Ohio wet prairies provided additional data in support of an idea which led to refinement of a hypothesis (Metzler et al. 2005) to explain east coast/midwest disjunct populations of prairie/wetland dependent species. In recognition of the occurrence of so many imperiled prairie and wetland dependent species of moths at Resthaven Wildlife Area's prairie on the south shore of Lake Erie the Ohio Division of Wildlife designated Resthaven's tallgrass prairie as a special refuge for moths.

Tallgrass prairie at Resthaven Wildlife Area, Erie Co., Ohio (E. Metzler photo)

White Sands National Monument New Mexico

Within the first 3 years of the moth study at the Monument I discovered 20 species of moths new to science; now the number of new species exceeds 30. As far as is known, all the new species are White Sands National Monument endemics. These data mean that **White Sands National Monument is home to more endemic species of moths than any other single location in North America.** The National Park Service is responding by devoting extra resources to this recently discovered biological treasure.

Two recently discovered and named, endemic species of moths from White Sands Nat. Mon.



Insects followed retreating glaciers up the Mississippi Valley and the east coast. (Metzler et al. 2005)

Discussion These results are only known because the moths were collected, killed, dissected, scientifically prepared, and studied. Most moths are small (wingspan less than 30 mm), and as my wife says, "They all look alike." Because most moths are active at night, detecting them and photographing them is extremely difficult. It is impossible to examine the internal genital organs of a living specimen. Only dead specimens from systematically collected samples allow the careful analysis leading to the discoveries, protection, and conservation results reported here.

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Figure 1: A PDF copy of this poster is available upon request.

folly. As evidence of this latter concept, I ask you to look at the dot maps for moths of economic importance in *Owlet Moths of Ohio* (Rings et al. 1992). All of the records of economic species are clustered along a transect running from Cleveland through Columbus to Cincinnati. This is the path of Ohio's 3-C highway, the main route by which entomologists traveled between Ohio's three largest cities to take samples from agricultural fields. Of course all the moth records are clustered along the 3-C highway. That's where all the sampling was done. Most counties have few to no records—where undoubtedly the moths occur in abundance. Anecdotal stories, as interesting as they are, too often

do not always stand up against hard facts. Fortunately I received entomology training as a student at Michigan State University. I learned the value of systematically collecting data, and I learned to save a few specimens of everything, even the black cutworm, from my traps. As an employee of the ODNR I learned the value of permits and reports.

All public agencies owning property rely on legislative bodies for their money. The agencies have to report usage data when it comes time for budgets. When entomologists apply for permits, they demonstrate to the agency a real need for the habitats where they want to gather samples. And the agencies want to know which species they are protecting, whether on purpose or by accident. Hunters and anglers have long known this, and they quickly purchase licenses and submit to tag checks and creel surveys. Organized hunters and anglers fully support pursuit and prosecution of poachers. Lepidopterists who irrationally support poaching do not advance official recognition that we do no harm. Campers know they have to pay to rent a spot or else there would be no spots. The only cost for an entomologist is requesting a permit and filing a report - pretty cheap stuff. The entomologist also has to know there is a cost to having the real estate available for research. It costs real money to buy, own, and manage the land. The land-owning agency often has to pay a tax offset to the local government for taking the land off the tax rolls or otherwise reducing the income (no more row crops or expensive houses) from taxes on the property. Entomologists are not the only people who want free access to the land to remove natural resources. Just ask yourself: how does a government agency decide who gets to collect moths, graze cattle, or harvest blueberries and timber? All the resources belong to all the taxpayers, and the governing body (legislature or commission or council, or somebody) should logically understand how the resources are allocated.

In my study of moths I look for patterns. The example of Ohio's 3-C highway is such a pattern. In another analysis I was able to demonstrate the direct distribution of Ohio's prairie-restricted moths to the distribution of prairie plants. Such an obviously simple concept seemed like rocket science when first employed in Ohio. The botanists already knew the distribution of *Silphium* spp. All I had to do is use their maps to find *Papaipema silphii*, and the prairies helped me find *Papaipema beeriana*. When I went to Ohio's few remaining sphagnum bogs in the northeastern part of the state I quickly found *Metaxaglaea inulta,* a denizen of sphagnum bogs. When looking for patterns I found that one third of Ohio's butterfly species clearly conform to Ohio's physiographic regions. Nobody knew that before I overlaid the maps, yet it makes sense that lepidopterans, which are plant dependent as larvae, will conform to plant distributions, which are dependent on soil chemistry, morphology, and many other factors.

How do my reports help the agencies? How does my sampling add to conservation? I have a few examples — I wish I had more, but hopefully they are coming as I recruit others to participate in my line of reasoning, and as we make friends with the agencies rather than considering them an impediment. Jeff Hooper in northeastern Ohio understands the principle perfectly when he obtained permissions to collect in some of Ohio's prime bog and fen reserves owned by the local metro parks district, and he vouchered the specimens in the Cleveland Museum of Natural History. Some of the attitudes I see on discussion groups on the web are myopic and paranoid, if not downright frightening. In addition to the case in point made by Jeff, of cooperating and making a contribution to science through accredited organizations, [BTW Jeff's collection will soon be deposited in the U.S. National Museum of Natural History (Smithsonian)], here are four further examples of positive outcomes, and I hope you can come up with more examples.

1) When I worked for ODNR I showed that the occurrence of the noctuid *Photedes inops* corresponded to the quality of a wetland. *Photedes inops* is now an Ohio state-listed species, because its habitat is threatened. The professional manner of The Ohio Lepidopterists allowed the organization to work with ODNR to permit sampling of this and other state-listed species as long as the collected specimens are reported to the state Division of Wildlife non-game biologists. It proved to be a win-win situation. With this cooperation, the state can identify habitats for management and protection, and *P. inops* benefits by having high quality habitats reported, available, and protected once they are discovered by lepidopterists.

2) Leland Martin was an amateur butterfly collector in northern Ohio who systematically scoured many local state parks and wildlife areas. Leland was amiable and got along well with the local authorities. When Leland found a colony of Duke's Skipper *Euphyes dukesi* in Findley State Park, he shared his discovery with park authorities. The park staff were so excited that they set aside that 1 or 2 acres as the Leland Martin Duke's Skipper Reserve. A plaque was installed, along with a mounted pair of the skippers, and Duke's skipper is mentioned on the Park's website with this sentence "One area of the park is set aside as a sanctuary for the Duke's skipper butterfly, an extremely rare insect" (ODNR 2014).

3) Before I left Ohio, I sampled moths in high quality prairies and highly degraded old fields in NW Indiana for The Nature Conservancy. Moths were sampled monthly, sorted to species, and counted. TNC hired a botanist to record plants at the same sites. When the data were analyzed, there was a direct correlation between the species of moths and the quality of the prairie (Shuey et al. 2012). In other words, the quality of a prairie could be estimated by looking at the listing of moths present at a given site.

4) When I came to New Mexico in 2005, the National Park Service (NPS) learned I was in town. I was invited by the NPS to an Inventory and Monitoring Conference in El Paso where I made an impassioned plea to include Lepidoptera along with the charismatic species, i.e. mountain lions and big horn sheep, as indicator species. Carlsbad Caverns National Park and White Sands National Monument responded by inviting me to do a 10-year study of moths in the respective preserves. Within 2 years at White Sands National Monument, I was confronted with about 30 moth species new to science (e.g. Metzler 2014a, 2014b, Metzler et al, 2009, Metzler & Forbes 2011a, 2011b, 2012). Now, the National Park Service wants to use my data to carefully examine the relationship of the moths to the plants, for indicators of climate change, and to convince the powers-that-be to make critical resources available for proper inventory and monitoring of insects in the Monument. I feel rewarded if the NPS allocates extra dollars for research or management at White Sands. I'm still an old-fashioned morphologist, while the high-tech guys and gals are already collecting DNA from my specimens for other studies, including a study related to color at the University of California, Berkeley.

This is all very exciting, and I believe that my sampling moths using indiscriminate-kill blacklight traps contributes directly to conservation. As long as I follow protocols, do the same thing each time I go out, and document and share my findings, there is progress. In this sense, my systematic collection of data and recording it in my field notes is no different than collecting data in other sciences. My son, a physicist at the University of Pennsylvania, always has his notebook at his side to record everything he does, and he sketches everything in the notebook. From day to day, his routine may seem trivial, but over time, the long-term accumulation of data can be invaluable.

Based on my experiences, I encourage all Lepidopterists to take a systematic approach to what they do. Publication of data, while not required, is useful. I recommend in-house newsletters (one of my primary outlets at ODNR) and collaboration to get papers in the Society's NEWS or Journal. And, please cooperate with the agencies and their rules. If they do not understand what they are doing, try to help them. For the Rangers of the NPS who wonder what I'm doing (after all, aren't these just common brown moths?), I give a one-hour presentation at their annual in-service training. It all pays off. They have a better understanding of the biotic resources that they are protecting, and they wave at me when I'm in restricted areas. On Christmas morning 2015 a ranger give me a high five and a loud shout of approval when I showed a handful of moths I collected Christmas Eve in my traps.

I am indebted to the members of the Conservation Committee for making many helpful comments on my earlier drafts.

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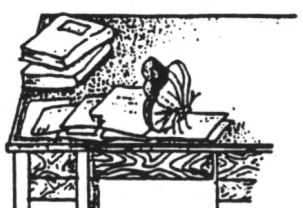

From the Editor's Desk

James K. Adams

I have been deeply ensconced in the Spring semester here at Dalton State College. The January temps have been chilly following some record breaking warmth (with surprisingly little moth-wise) around Christmas. I did get my earliest *Feralia major* ever for north GA on Christmas Eve, but that's been the excitement for this winter season.

The last two issues of the News were very full and I did not put any entries for the Formative Experiences or First Encounters columns in them, but I am looking for more of these from you for future issues. Please send entries for these columns in SOON. Thanks!