AMCOP 68
June 9-11, 2016
Touch of Nature Environmental Center
Southern Illinois University in Carbondale
Makanda, IL 62958

Contents

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Acknowledgements

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For support of the LaRue, Cable, and Honorable Mention Awards and other expenses.

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THE COLLEGE OF SCIENCE, DEPARTMENT OF ZOOLOGY AND SIU SIGMA XI CHAPTER

The 68th Annual Midwestern Conference of Parasitologists provides 4 Continuing Education Credits (4 CE).
Your registration confirmation is proof of your attendance.

SCHEDULE

THURSDAY, JUNE 9, 2016

2:00-5:00 pm Room Check-in at Front Desk of Little Grassy Lodge

6:00-8:00 pm Opening Mixer: Giant City Lodge, 460 Giant City Lodge Rd, Makanda, IL 62958

FRIDAY, JUNE 10, 2016

Touch of Nature Environmental Center
The Friends Room

8:00am Continental Breakfast (The Friends Room), Silent Auction Set Up (Back of the Friends Rooms)

8:45am Opening Remarks and Welcome (The Friends Room)

- Dr. Agustín Jiménez, Program Officer

CONTRIBUTED PAPERS

(STUDENT PAPERS INDICATED BY *)

9:00 1* Morphological and physiological effects of *Paragordius varius* (nematomorpha: gordiida) on the cricket host, *Acheta domesticus*. CHRISTINA ANAYA **(GS)***[1,3], LARISA VREDEVOE[1], GITA KOLLURU[1], BEN HANELT[2] and MATT BOLEK.[3] [1]California Polytechnic State University, San Luis Obispo, California. [2]University of New Mexico, Albuquerque, New Mexico. [3]Oklahoma State University, Stillwater, Oklahoma 74074

9:15 2* In vivo and in vitro treatment of monogeneans and digeneans with praziquantel. **CHRIS BADER (GS)**, JEBA JESUDOSS CHELLADURAI (GS), and MATTHEW BREWER (MP), Department of Pathology, Iowa State University, Ames, IA 50011

9:30 3* The identification of the exotic waterfowl trematode *Neopsilotrema lisitsynae* (Trematoda: Psilostomidae) in the United States. **TYLER ACHATZ (GS),** DANA BENNETT (UG) and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001.

9:45 4* Adding missing links: an empirical assessment of the role of birds in parasite life cycles and food webs. **OLIVIA N CHOI (GS)**, ROBERT C JADIN (MP), SARAH A ORLOFSKE (MP). Department of Biology, Northeastern Illinois University, Chicago, IL 60625.

10:00 5* Fighting for fitness: Can parasites alter their life history in response to host stress? **ALYSSA M. GLEICHNSER (GS)**, JESSICA A. CLEVELAND (UG), and DENNIS J. MINCHELLA (MP), Department of Biological Sciences, Purdue University, West Lafayette, IN 47907

10:15 6* Molecular snapshot of *Ascaris* from pigs in the largest hog producing region in the United States. **JEBA JESUDOSS CHELLADURAI (GS)**, KAITLYN MURPHY (UG), TYMBRIE SNOBL (UG), CHRISTOPHER BADER (GS), CODY WEST (UG), KYLIE THOMPSON (GS), MATTHEW T. BREWER (MP)**.** Department of Veterinary Pathology, Iowa State University, Ames, IA 50014.

10:30 BREAK & SILENT AUCTION BIDDING (Storage Cabinet of Friends Room)

10:45 7* Comparative trematode community structure in nine species of waterfowl collected from Lake Winnibigoshish, Minnesota. **SCOTT MALOTKA (GS)** & ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University Mankato, Mankato, MN 56001

11:00 8* DNA Barcoding Reveals Cryptic Species of White Grub Infecting Spring Lake Fishes. **SAMANTHA MCCARREL (GS)** and SHAWN MEAGHER (MP), Biological Sciences, Western Illinois University, Macomb, IL 61455

11:15 9* Islands in the sky? Potential predictors of macroparasite species richness in a montane Neotropical anuran-macroparasite system. **JOSHUA PARROTT (GS)**, ALESSANDRO CATENAZZI (UG), and F. A. JIMÉNEZ (MP), Department Of Zoology, Southern Illinois University, Carbondale Illinois 62901-6501.

11:30 10* Amphibian Trypanosomes From The Great Plains: Morphology, Motility, And Phylogenetic Relationships. **RYAN P. SHANNON (GS)** and MATTHEW G. BOLEK (MP). Department of Integrative Biology, Oklahoma State University. Stillwater, OK.

11:45 11* Giant liver fluke and thin-necked bladderworm from hunter-harvested white-tailed deer: coinfection and landscape patterns. **J. TREVOR VANNATTA (GS)** and RON MOEN (MP), Natural Resources Research Institute, University of Minnesota, 5013 Miller Trunk Highway, Duluth, MN 55811.

12:00 12* High prevalence of *Cytauxzoon felis* in bobcats and ticks in a newly described enzootic region: southern Illinois. **ELLIOTT ZIEMAN[1,2] (GS)**, CLAYTON K. NIELSEN[2,3] (MP) and F. AGUSTÍN JIMÉNEZ[1] (MP). [1]Department of Zoology, Southern Illinois University Carbondale, IL. 62901-6501, [2]Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL. 62901, [3]Department of Forestry and Center for Ecology, Southern Illinois University, Carbondale, IL. 62901-4619.

12:15 Lunch

THE AMCOP SYMPOSIUM
The Friends Room

1:30 **Dr. Julián Hillyer** Vanderbilt University
Functional integration of the immune, circulatory and respiratory systems of mosquitoes in the anti-pathogen response

2:30 **Dr. Makedonka Mitreva** Washington University in St. Louis
Soil transmitted helminths and the human gut microbiome

POSTER SESSION
Indian Building
(Poster Set up starts following Symposium)

4:00 5:30

19. *Comparative trematode biota of healthy American coot and ring-necked duck harvested from Lake Winnibigoshish, MN. **TYLER ACHATZ (GS),** TIMOTHY CHRISTOPHERSON (UG), RAINE MITCHELL (UG), CONNOR HUTTON (UG), MIRIAH LINVILLE (UG), OKHUMHEKHO KASSIM (UG), JACOB RACHUY (UG), and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

20. *Identification of new species *Neopsilotrema itascae* n. sp. and reclassification of *Psilotrema mediopora* to *Neopsilotrema mediopora* n. comb. **TYLER ACHATZ (GS)** and ROBERT SORENSEN, Ph.D. (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

21. *Observations on the life history of *Gordius* cf. *robustus* (Nematomorpha: Gordiida) from Oklahoma. Is this the first documented semi-terrestrial hairworm life cycle? **CHRISTINA ANAYA (GS)***[1], Ben Hanelt[2] and Matthew G. Bolek[1]. [1]Oklahoma State University. [2]University of New Mexico.

22. *Analysis of humoral immune responses in horses with equine protozoal myeloencephalitis. **KATY-JANE ANGWIN (GS)** and DANIEL HOWE (MP), M.H. Gluck Equine Research Center, Department of Veterinary Science, University of Kentucky, Lexington, KY 40546.

23. *Genetic & morphological description of echinostomatids taken from waterfowl at Lake Winnibigoshish, Minnesota. **DANA BENNETT (UG)**, TYLER ACHATZ (GS), and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

24. *Genetic and morphological description of *Leyogonimus polyoon* (Trematoda: Leyogonimidae) harvested from *Fulica americana* of Lake Winnibigoshish, Minnesota. **DANA BENNETT (UG),** TYLER ACHATZ (GS)**,** and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

25. *The Helminths of the Short-tailed Cane Mouse, *Zygodontomys brevicauda* (Rodentia: Cricetidae) in French Guiana. **HAYLEY FALAT (UG)** and F. AGUSTÍN JIMÉNEZ (MP), Department of Zoology, Southern Illinois University, Carbondale, IL 62901

26. Detection of *Borrelia*, *Ehrlichia*, and *Rickettsia* spp. in Ticks in Adair County of Northeast Missouri. **D. A. HUDMAN (RA)** and N. J. SARGENTINI (TF)**.** Department of Microbiology & Immunology, A.T. Still University, Kirksville, MO 63501

27. *Does sex or age affect infection levels in mice? **ASHLEY HUETTE (UG)** and SHAWN MEAGHER (MP), Biological Sciences, Western Illinois University, Macomb, IL 61455

28. *Improving transfection efficiency in the apicomplexan parasite *Sarcocystis neurona.* **EMILY LEBEAU (GS)** College of Veterinary Medicine, Lincoln Memorial University, Harrogate, TN 37752; DANIEL HOWE (MP) and MICHELLE YEARGAN (T), Gluck Equine Research Center, Department of Veterinary Science, University of Kentucky, Lexington, KY 40546

29. *Inter- and Intra-clonal Comparisons of *Schistosoma mansoni* Cercariae. **SARAH MARSHALL (UG)**, Department of Biology, Purdue University, West Lafayette, IN 47906

30. *Does fire affect parasitism in midwestern white-footed mice? **JANIE MILLER (UG)** and SHAWN MEAGHER (MP), Biological Sciences, Western Illinois University, Macomb, IL 61455

31. *New Distribution Records, Molecular Data And Review Of The Genus *Hepatozoon* (Apicomplexa: Adeleorina) Infecting North American Anurans. **RYAN P. SHANNON (GS)** and MATTHEW G. BOLEK (MP), Department of Integrative Biology, Oklahoma State University, Stillwater, OK.

32. Cytokine response of human THP-1 macrophages to *Trichomonas tenax* (Trichomonadida: Trichomonadidae). EMILY J. GOVRO (MS) and **MELISSA K. STUART (MP)**, Department of Microbiology/Immunology, A.T. Still University of Health Sciences, 800 W. Jefferson St., Kirksville, Missouri 63501.

33. *Observations on the Morphological Characteristics of Adult *Sphaeridiotrema pseudoglobulus* from Lake Winnibigoshish. **Lindsay Strommen* (UG), Madison Teasley* (UG),** Scott Malotka (GS), & Robert Sorensen (MP), Department of Biological Sciences, Minnesota State University Mankato, Mankato MN 56001

34. *Giant liver fluke in North American cervids: just a fluke? **J. TREVOR VANNATTA (GS)** and RON MOEN (MP), Natural Resources Research Institute, University of Minnesota, 5013 Miller Trunk Highway, Duluth, MN 55811

35. Natural and Experimental Infections of *Daubaylia* sp. in *Helisoma trivolvis* and other Freshwater Snails. KYLE D. GUSTAFSON (GS), LUKE BALL (UG) and **MATTHEW G. BOLEK (MP)**, Department of Integrative Biology, Oklahoma State University, Stillwater, OK.

36. DNA barcoding reveals two distinct species of white grub in green sunfish. TORI WORTHEN (UG) and **SHAWN MEAGHER (MP)**, Biological Sciences, Western Illinois University, Macomb, IL 61455

37. *In silico* analysis of the structure of putative *daf-16* homologues of *Hymenolepis diminuta* and *H. microstoma*. KATHERINE E. HOLLERAN (UG), KAITLIN P. ESSELMAN (UG) and **DOUGLAS B. WOODMANSEE (MP)**, Department of Biology, Wilmington College, Wilmington OH 45177.

BANQUET

The Friends Room

Cash bar opens 6:00 The Friends Room
Dinner begins at 6:30 The Friends Room

KEYNOTE SPEAKER

Dr. Karl Reinhard University of Nebraska, Lincoln
"Archaeoparasitology 2015-2020: Transitions in Theory and Crises in Diagnosis"

SATURDAY, JUNE 11, 2015.

The Friends Room

8:00 Continental Breakfast (The Friends Room) & Silent Auction Bidding (Cabinet of The Friends Room)

9:00 13* The utilization of morphological and genetic diagnostic techniques for the description of *Australapatemon* species collected from waterbirds of Lake Winnibigoshish, Minnesota. **DANA BENNETT (UG)**, TYLER ACHATZ (GS), and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

9:15 14* Swimming in disease: parasite diversity driven by water quality. **JASON BLOCK (UG)**, ROBERT C. JADIN (MP), SARAH A. ORLOFSKE (MP). Department of Biology, Northeastern Illinois University, Chicago, IL, 60625

9:30 15* Implantation of *Acanthocheilonema viteae* females pre-selected for high fecundity *in vitro* improves infection outcome in Mongolian jirds (*Meriones unguiculatus*). **ZACHARY HEIMARK (UG)**, Steven Schaar (T), Zach Williams (GS), Amy Hoechst (T), Laura Teigan (T), Michelle Michalski (MP). Department of Biology and Microbiology, University of Wisconsin, Oshkosh, WI 54901

9:45 16* Finding three P's in a pond: Assessing the diversity of three plagiorchids in Midwestern wetlands. **ALMA G. MENDOZA (UG)**, ROBERT C. JADIN (MP), AND SARAH A. ORLOFSKE (MP), Department of Biology, Northeastern University, Chicago, IL 60625.

10:00 17 Using gordiid cysts to discover the hidden diversity, potential distribution and new species of hairworms (Nematomorpha: Gordiida). **MATTHEW G. BOLEK[1] (MP)**, CLEO SZMYGIEL[1] (GS), RYAN P. SHANNON [1] (GS), MONICA PAPEŞ[1] (MP), ANDREAS SCHMIDT-RHAESA[2] (MP) and BEN HANELT[3] (MP), [1]Department of Integrative Biology, Oklahoma State University; [2]Zoological Museum and Institute, Hamburg, Germany. [3]Department of Biology, University of New Mexico.

10:15 18 Morphological asymmetry and habitat quality: using fleas and their rodent hosts as a novel experimental system. **ELIZABETH M. WARBURTON (PD)**, IRINA S. KHOKHLOVA (PI), DANIEL KIEFER (PD), and BORIS R. KRASNOV (PI). Mitrani Department of Desert Ecology, Jacob Blaustein Institutes for Desert Research, Ben Gurion University of the Negev, Midreshet Ben Gurion, Israel 8499000

10:30 Continental Breakfast (The Friends Room) & Silent Auction Bidding Closes (Cabinet of The Friends Room)

11:30 Business Meeting and Award Presentations. Dr. Matthew Brewer, AMCOP Presiding Officer

Dorm check out by noon.

ABSTRACTS

1. Morphological and physiological effects of *Paragordius varius* (Nematomorpha: Gordiida) on the cricket host, *Acheta domesticus*.
CHRISTINA ANAYA (GS)*[1,3], LARISA VREDEVOE[1], GITA KOLLURU[1], BEN HANELT[2] and MATT BOLEK.[3] [1]California Polytechnic State University, San Luis Obispo, California. [2]University of New Mexico, Albuquerque, New Mexico. [3]Oklahoma State University, Stillwater, Oklahoma 74074

Freshwater gordiids have complex life cycles which include multiple hosts and a free-living aquatic phase. At the end of their parasitic phase, gordiids manipulate the behavior of their terrestrial arthropod hosts, causing them to enter aquatic environments where adult worms emerge often at the expense of the host's mortality. All gordiids develop in the hemocoel of their terrestrial arthropod host. Within the host, gordiids grow from a small length of 60–100 µm to a length of over 2 m for some species. Anecdotal field observations indicate that arthropod hosts appear to show a high degree of hairworm-induced pathology. Some reports indicate that after worms emerge from their hosts, only the gut remains within the arthropod's body cavity, whereas other studies indicate that the production of eggs by female arthropod hosts is inhibited or absent altogether. The focus of this investigation was to evaluate if infection by hairworms alters growth rate, depletes lipids, and reduces fecundity in their arthropod host. To test the effect of hairworm parasitism on the arthropod host, 4-week old female house crickets (*Acheta domesticus*) were infected with the hairworm *Paragordius varius.* Once worms emerged from their cricket hosts, cricket body length, femur length, and ovipositor length as well as lipid mass and egg production were measured and compared with control sham-infected crickets. In an independent study, infected crickets that survived infection, were provided food and water and observed for post-infection egg production. Our results indicate that cricket body length and ovipositor length, as well as fat body content and egg production were significantly reduced in infected crickets compared to sham-infected control crickets. In post-infected crickets, females were found to contain lipids, eggs, and/or hairworms. This work is the first to demonstrate post infection egg production for crickets infected with *Paragordius varius* and the first to

experimentally document the negative effects of hairworm parasitism on their arthropod hosts and will be discussed and compared to field observations on arthropod hairworm infections.

2. In vivo and in vitro treatment of monogeneans and digeneans with praziquantel. **CHRIS BADER (GS)**, JEBA JESUDOSS CHELLADURAI (GS), and MATTHEW BREWER (MP), Department of Pathology, Iowa State University, Ames, IA 50011

   According to the Food and Agriculture Organization of the United Nations in 2013 70.2 million tons of farmed food fish were produced in the world. In food fish ectoparasites are thought to be the most important pathogenic organisms when dealing with fish farm mortalities. Ectoparasites infections can also lead to secondary infection of bacteria and fungi at these sites. In addition to increased mortality, trematode parasitism of captive fish also result to a decrease in weight gain. In most food animals platyhelminth infections are treated with praziquantel, but there are currently no anthelminthics approved for aquaculture. This study examined the effect of praziquantel on *Dactylogyrus in vivo* and *Posthodiplostomum minimum in vitro* from farm reared crappies and wild caught bluegill. We also examined novel ways to measure the mortality of non-motile digenean parasites.

3. The identification of the exotic waterfowl trematode *Neopsilotrema lisitsynae* (Trematoda: Psilostomidae) in the United States. **TYLER ACHATZ (GS),** DANA BENNETT (UG) and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001.

   Neopsilotrema lisitsynae (Digenea: Psilostomidae) was originally described only from waterfowl collected in Ukraine. This study documents the presence of *N. lisitsynae* in North American waterfowl for the first time. A survey of hunter-shot waterfowl from Lake Winnibigoshish, MN, in the fall 2012 and spring 2013 yielded 4 novel hosts for *N. lisitsynae*: mallard (*Anas platyrhynchos*), blue-winged teal (*Anas discors*), ring-necked duck (*Aythya collaris*) and lesser scaup (*Aythya affinis*). These worms were found primarily in the anterior to middle stretches of the small intestine with fewer individuals throughout the remainder of the gastrointestinal tract, but none were found within the cecae. A wider range of body measurements was associated with adults from North American hosts compared to the Ukrainian specimens; in addition, the specimens described here suggest host-specific morphometric variation. Body spines were not evident through scanning electron microscopy. Nucleotide information from 28S ribosomal DNA sequences showed one shared variable nucleotide site amongst the eleven individuals from the four birds collected in the fall and two from mallards harvested in the spring. Additional variable loci including ITS rDNA and NAD mitochondrial DNA (mtDNA) sequences were obtained for several morphotypes with no variation detected between isolates.

4. Adding missing links: an empirical assessment of the role of birds in parasite life cycles and food webs. **OLIVIA N CHOI (GS)**, ROBERT C JADIN (MP), SARAH A ORLOFSKE (MP). Department of Biology, Northeastern Illinois University, Chicago, IL 60625.

   Although ecologists suggest food webs are powerful tools for examining the effects of urbanization, there have been few studies using food webs to understand the impacts of human development. Furthermore, food webs historically excluded parasites due to difficulties in collection and their perceived lack of importance. However, evidence indicates that parasites can change food-web structure and stability. In addition, parasites and birds connect aquatic and terrestrial ecosystems and while the communities of parasites that colonize bird digestive tracts are well studied, little is known about the roles these parasites play within these ecosystems. Bird parasites are rarely sampled in the process of constructing food webs due to ethical considerations and difficulty in tracking them. Therefore we are limited to existing literature from distant areas and historical periods to infer their possible parasite communities. To address whether this biases food web properties, we quantitatively measured the abundance, distribution, and diversity of parasitic flatworms (phylum Platyhelminthes, class: Cestoda and Trematoda) from multiple avian hosts (ducks and gulls) to create and verify aquatic food web models of wetlands in the Greater Chicago area. Bird carcasses donated by regional airports and hunters through regional chapters of Ducks Unlimited were dissected for parasites. Parasites were isolated and preserved in ethanol for morphological or molecular identification. Primers for the NAD1 and 28S genes (cestodes) and the ITS1 and ITS2 gene loci (trematodes) were used for PCR. We combined species presence and abundance from bird dissections with survey data of larval stages in the wetlands and the literature of the life cycles of these parasites. From this data we inferred intermediate hosts that serve as prey for the birds to create a matrix of predator-prey and parasite-host relationships. We used R statistical software to build network models of the inferred food webs across an urbanization gradient and analyzed metrics that rank the importance of species based on connections within the network. These results were compared to food webs generated without our parasite survey data. Based on the food webs generated, there is a clear difference between the empirical food web and the food web based on existing literature: the literature web had more nodes and edges than the empirical. The results of this study imply that the empirical web is a more accurate representation of the specific ecosystem studied here. The results of this study shed light on parasite community dynamics and the contribution of parasite life cycles to food web structure and the potential for biotic homogenization (become uniform) among parasites with anthropogenic change. In addition, the generation of more accurate food webs will lead to better predictions of the effects of environmental change such as the introduction of an invasive species or climate change.

5. Fighting for fitness: Can parasites alter their life history in response to host stress? **ALYSSA M. GLEICHNSER (GS)**, JESSICA A. CLEVELAND (UG), and DENNIS J. MINCHELLA (MP), Department of Biological Sciences, Purdue University, West Lafayette, IN 47907

Climate change will alter the stress levels and selective pressures for parasites and their hosts. While previous research has focused on whether host species can respond to climate change stressors, few studies have investigated whether parasites are able to detect and respond to host stress. The goal of this study was to determine whether parasites can alter their life history strategies to favor their survival and fitness when infecting hosts in a drought-stressed environment. We used the human parasite *Schistosoma mansoni* and its aquatic snail intermediate host *Biomphalaria alexandrina,* which live in areas predicted to face increased drought pressure. We predicted that 1. Drought-stressed snails would have lower growth and higher reproduction than unstressed snails, and 2. Parasites in drought-stressed snails would produce more cercariae than parasites in unstressed snails. Unstressed snail hosts exposed to the parasite demonstrated a significant reproductive burst during the pre-patent period (fecundity compensation), but that response was absent in a drought-stressed environment. We found that infections in drought-stressed snails had significantly higher parasite reproductive outputs than infections in unstressed snails. This is only study that we know of that documents fecundity compensation by a parasite, in which the parasite alters its life history to increase fitness in response to a stressor. This finding suggests that climate change may alter the infection dynamics of this debilitating human parasite.

6. Molecular snapshot of *Ascaris* from pigs in the largest hog producing region in the United States. **JEBA JESUDOSS CHELLADURAI (GS)**,

KAITLYN MURPHY (UG), TYMBRIE SNOBL (UG), CHRISTOPHER BADER (GS), CODY WEST (UG), KYLIE THOMPSON (GS), MATTHEW T. BREWER (MP**)**. Department of Veterinary Pathology, Iowa State University, Ames, IA 50014.

The zoonotic round worm *Ascaris* is prevalent globally, infecting pigs and >807 million people. In parts of the world where humans and pigs are sympatric, *Ascaris* can be cross-transmitted from pigs to humans and vice versa, providing opportunities for worm hybridization. In the United States, the majority of commercially raised pigs are raised in confinement with few individuals being directly involved in their care. We hypothesized that this scenario isolates populations of swine *Ascaris*, thereby making them genetically distinct as compared to *Ascaris* found in other areas of the world. To test this hypothesis, we examined the genetic structure of *Ascaris* derived from pigs in Iowa, the largest hog producing state, using nuclear and mitochondrial markers. Marked genetic diversity was observed, including novel mitochondrial haplotypes. Phylogenetic relationships were elucidated. The relevance of the molecular data in understanding transmission and dispersal is discussed.

7. Comparative trematode community structure in nine species of waterfowl collected from Lake Winnibigoshish, Minnesota. **SCOTT MALOTKA (GS)** & ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University Mankato, Mankato, MN 56001

Waterfowl possess the ability to have intensely high parasite loads, which in some cases can lead to serious consequences for the host. Although several published reports have examined the helminth communities in waterfowl throughout various regions of the United States, little is known about the trematode fauna in waterfowl migrating through Minnesota. Therefore, the current study was undertaken to examine the trematode community present in the gastrointestinal tracts of nine different species of waterfowl collected from Lake Winnibigoshish in northern Minnesota. In total, 52 birds including 18 blue-winged teal (*Anas discors*), 5 bufflehead (*Bucephala albeola*), 4 common goldeneye (*Bucephala clangula*), 1 greater scaup (*Aythya marila*), 1 green-winged teal (*Anas carolinensis*), 11 lesser scaup (*Aythya affinis*), 1 northern pintail (*Anas acuta*), 1 redhead (*Aythya americana*), and 10 wood duck (*Aix sponsa*) were collected by licensed waterfowl hunters during the fall and spring migration seasons in 2012 and 2013, respectively. Morphological analysis of the trematodes collected revealed 14 different species, of which *Maritrema obstipum*, *Neopsilotrema lisitsynae*, *Notocotylus attenuatus*, and *Zygocotyle lunata* were the most common. Two mortality-related trematodes, namely

Cyathocotyle bushiensis and *Sphaeridiotrema pseudoglobulus*, were also observed in blue-winged teal, bufflehead, greater scaup, lesser scaup, and redhead. Interestingly, of all bird species examined, lesser scaup was found to harbor the largest number of trematodes and exhibited the greatest diversity of species while green-winged teal were not found to be infected with any trematode species. Altogether, these efforts to describe the baseline parasite community structure in Minnesotan waterfowl are necessary for future studies given the environmental changes, including introduced species, habitat loss, and climate change, that are forecasted to take place worldwide.

8. DNA Barcoding Reveals Cryptic Species of White Grub Infecting Spring Lake Fishes. **SAMANTHA MCCARREL (GS)** and SHAWN MEAGHER (MP), Biological Sciences, Western Illinois University, Macomb, IL 61455.

Parasites are the most common organisms on Earth. Molecular techniques suggest that the true number of parasitic species may be underestimated, due to the existence of cryptic species, which are morphologically indistinguishable, but genetically distinct. Cryptic species may be found among apparently generalist parasites that occur in multiple host species. *Posthodiplostomum minimum centrarchi,* or "white grub," is a parasitic flatworm (fluke) that infects over 20 species of centrarchid fishes. I examined species diversity of *P. minimum* infecting four host species found in Spring Lake, McDonough County, IL: bluegill (*Lepomis macrochirus*), green sunfish (*L. cyanellus)*, largemouth bass (*Micropterus salmoides)* and white crappie (*Pomoxis annularis)*. Genetic distance-based analyses of DNA barcode regions (mtDNA CO1 and nuclear rDNA ITS) were performed for 95 worms. The frequency distribution of genetic distances revealed multiple genetically distinct worm lineages. Analyses revealed both small genetic distances (mean=0.01 substitutions/nucleotide), indicative of low variation within species, and large distances (0.16 substitutions/nucleotide), indicating high divergence between species. Neighbor-joining trees revealed three distinct worm clusters, each of which corresponded to previously identified genetic types (i.e. "species") of *P. minimum* that are not yet formally described. These 3 genetic types displayed distinct patterns of host specificity. This discovery of multiple worm species in a single lake suggests that more data are required to determine exactly how many species of *P. minimum* there really are.

9. Islands in the sky? Potential predictors of macroparasite species richness in a montane Neotropical anuran-macroparasite system. **JOSHUA**

PARROTT (GS), ALESSANDRO CATENAZZI (UG), and F. A. JIMÉNEZ (MP), Department Of Zoology, Southern Illinois University, Carbondale Illinois 62901-6501.

The theory of Island Biogeography has recently been applied to Neotropical anuran-macroparasite systems with varying degrees of success. A major shortcoming of those studies is the unknown disparity in habitat use, distribution, habits and phylogeny between the compared hosts, something which may affect the distribution of helminths.. In addition, some of these studies are meta-analyses in which survey effort needs to be accounted for. This study complements those meta-analyses by utilizing individuals of a single host genus which are similar in size, habits, and captured during a single season. These data show a significant negative relationship between elevation and parasite species richness per frog. We also find significant differences in parasite abundance per frog across sites, parasite genera, and interactions between these two factors. Prevalence of infection and mean intensity of infection does not vary significantly between host frog species, delineated sites, nor with respect to parasite group. Host frog size, hypothesized to be a predictor of parasite numbers, is not a significant factor within these data. Parasite community composition varies little across sites and community dissimilarity between sites does not correlate significantly with distance.

10. Amphibian Trypanosomes From The Great Plains: Morphology, Motility, And Phylogenetic Relationships. **RYAN P. SHANNON (GS)** and MATTHEW G. BOLEK (MP). Department of Integrative Biology, Oklahoma State University.

From May-August 2014-2015, 200 amphibians from 5 families and 9 species were examined for trypanosomes, leeches and leech hematomas. Of those, only bullfrogs (*Rana catesbeaiana*) and southern leopard frogs (*Rana sphenocephala*) were infected with *Trypanosoma* spp., but no leeches or hematomas were observed on any of the amphibians examined. Five species/morphotypes of trypanosomes infected adult southern leopard frogs and adult bullfrogs. All five trypanosome morphotypes conform to previous descriptions of (1) *Trypanosoma ranarum*, (2) *T. schmidti,* (3) *T. loricatum*, (4) *T. rotatorium*, and (5) *T. chattoni*. Both leeches and dipterans have been reported as vectors for amphibian trypanosomes. To evaluate how and when frogs become infected with trypanosomes, we sampled for potential leech and dipteran vectors and examined tadpoles, newly metamorphed and adult leopard frogs for trypanosome infections. One species of leech (*Placobdella rugosa*), 2 species of mosquitoes (*Culex erraticus*, and *Uranotaenia sapphirina*) and biting midges, *Forcipomyia* spp., were collected as potential vectors. However, trypanosome prevalence and richness increased as frogs aged being 0 in tadpoles, 9% and 0.09 ± 0.3 in metamorphs and 59% and 1 ± 1.2 in adult frogs, suggesting that frogs are infected with trypanosomes via dipterans after metamorphoses. Trypanosome morphotypes separated into distinct groups based on morphological measurements and video-microscopy revealed distinct differences in trypanosome motility. Finally, the 18s rRNA gene of each morphotype was sequenced. Phylogenetic analyses reinforced morphological identification of *T. ranarum*, but some morphotypes remain ambiguous, possibly representing new species of trypanosomes infecting amphibians in Oklahoma.

11. Giant liver fluke and thin-necked bladderworm from hunter-harvested white-tailed deer: coinfection and landscape patterns. **J. TREVOR VANNATTA (GS)** and RON MOEN (MP), Natural Resources Research Institute, University of Minnesota, 5013 Miller Trunk Highway, Duluth, MN 55811.

    The giant liver fluke, *Fascioloides magna*, and thin-necked bladderworm, *Taenia hydatigena*, are parasites of unknown significance for white-tailed deer. However, the prevalence of giant liver fluke is increasing in many locations across North America. Between the winters of 2014 and 2015, 125 white-tailed deer livers were collected from the city of Duluth, Minnesota, USA. Prevalence of giant liver fluke was 42% and prevalence of thin-necked bladderworm was 18%. Coinfection with both parasites was also common (14%) and a statistically significant association between infections was found. This association may have been related to abiotic factors, deer behavior, or immunology. Fluke biomass in deer livers correlated strongly with the area of emergent herbaceous wetlands and woody wetlands in deer hunting areas. Bladderworm infection metrics were not strongly correlated with any landscape variable.

12. High prevalence of *Cytauxzoon felis* in bobcats and ticks in a newly described enzootic region: southern Illinois. **ELLIOTT ZIEMAN[1,2] (GS)**, CLAYTON K. NIELSEN[2,3] (MP) and F. AGUSTÍN JIMÉNEZ[1] (MP). [1]Department of Zoology, Southern Illinois University Carbondale, IL. 62901-6501, [2]Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL. 62901, [3]Department of Forestry and Center for Ecology, Southern Illinois University, Carbondale, IL. 62901-4619.

    Cytauxzoon felis is an intraerythrocytic Apicomplexan parasite of felines in the southeastern US. Infection in domestic cats (*Felis catus*) can result in the highly fatal cytauxzoonosis. Bobcats (*Lynx rufus*) are the natural host and often show no apparent pathology associated with infection by *C. felis*. The lone star tick (*Amblyomma americanum*) and the American dog tick (*Dermacentor variabilis*) are competent vectors of *C. felis*. Previous work on *C. felis* has addressed the infection in one host species in a specific geographic region. In particular, distribution of the parasite in tick vectors was based on ticks removed from domestic animals and humans. A comprehensive study of the distribution of the parasite in both questing ticks and felines is necessary. Our study had two general objectives: i) to determine the prevalence and parasitemia of *C. felis* in bobcats and prevalence in questing tick vectors, and ii) to compare the genetic diversity of *C. felis* among different hosts. We screened tissues of 150 bobcats, 218 ticks (117 *A.* americanum, 101 *D.* variabilis), 14 domestic cats suspected to suffer cytauxzoonosis, and 36 asymptomatic domestic cats for the presence of *C. felis* using polymerase chain reaction (PCR) with specific primers. Bobcats from Illinois showed a prevalence of 70%, whereas ticks had a prevalence of 15.6% with no difference between species. Thirteen cases of cytauxzoonosis were confirmed in domestic cats and 12 of 36 (33.3%) of asymptomatic domestic cats were positive for *C. felis* infection. This is the first study to examine a local population of ticks, domestic cats and bobcats. Our data indicate a very high prevalence in ticks and bobcats. Future research must address the role of domestic cats as reservoirs of this pathogen, the identification of foci of the disease and the effects of chronic infection in bobcats.

13. The utilization of morphological and genetic diagnostic techniques for the description of *Australapatemon* species collected from waterbirds of Lake Winnibigoshish, Minnesota. **DANA BENNETT (UG)**, TYLER ACHATZ (GS), and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

Trematodes of the Family Strigeidae have a complex history of morphological and genetic diagnoses. *Australapatemon* species of the current study were harvested from hunter-shot mallards (*Anas platyrhynchos*), lesser scaup (*Aythya affinis*), and ring-necked ducks (*Aythya collaris*) of Lake Winnibigoshish, Minnesota in fall 2012 and spring 2013. Morphological characteristics and genetic analysis were utilized for species diagnosis. Samples from both fall and spring birds were genetically analyzed using 28S rDNA, ITS rDNA, and partial CO1 mitochondrial DNA to postulate taxonomic affinities through comparison of genetic sequences from these worms to those from previously published sequences. Of the harvested Strigeidae members that were analyzed, samples from fall and spring were both most closely associated with the morphological description of *Australapatemon burti* (Miller, 1923).

However, genetic analysis associated both samples of this study with *Australapatemon niewiadomski* at the 28S rDNA locus, but were highly divergent up to 11% at the CO1 locus, supporting the lack of validity of the 28S locus for species-level diagnosis. To elucidate this finding, available morphometrics associated with various *Australapatemon* species were compared to current study samples. Currently accepted *Australapatemon* species have highly varying morphotypes. Taking this into account along with genetic data, one unidentified species was found in ring-necked ducks and another unidentified species was present in both mallards and lesser scaup.

14. Swimming in disease: parasite diversity driven by water quality. **JASON BLOCK (UG)**, ROBERT C. JADIN (MP), SARAH A. ORLOFSKE (MP)**.** Department of Biology, Northeastern Illinois University, Chicago, IL, 60625

Fertilizers used on crops and on urban lawns run into aquatic habitats disrupting water chemistry (i.e. adding extra nutrients such as phosphorus or nitrogen). This leads to uncontrolled algae growth, which can take up dissolved oxygen in the water. The lack of oxygen can negatively affect other organisms leading to population declines. One potential indirect measure of water quality could be the use of snails and their associated parasites. Many parasites of aquatic species have complex life cycles involving several host species leading to the proposal of parasites as indicators of ecosystem health. In this study, we examined the relationship between several water quality variables in freshwater wetlands and the parasite diversity within those communities. We sampled four focal snail species (*Gyraulus* sp., *Helisoma* sp., *Lymnaea* sp., and *Physa* sp.) at seven different wetlands in northeastern Illinois and southwestern Wisconsin. Each snail was examined for the release of infective stages of parasites or dissected to identify the parasite stages within the snails. We identified larval cercariae to the lowest taxonomic level possible by using both morphological and molecular techniques. During field surveys, we collected data on water temperature and dissolved oxygen. Additional tests for phosphorus, nitrate, and nitrite, were made using a water quality kit on water samples returned to the laboratory. For this study, the greatest parasite richness was ten different species. Some of the species of parasites that were found included the plagiorchids *Alloglossidium* sp., *Glypthelmins* sp., *Haematoloechus* sp., and *Plagiorchis* sp., as well as echinostomes and *Ribeiroia ondatrae*. The site that had the highest nitrogen and phosphorus values was associated with eight parasite species. However, there was no significant relationship between parasite species richness and phosphorus concentrations for our first and second visit (P = 0.445 and 0.370).

Similarly, parasite species richness was not significantly related to nitrogen levels for our first visit ($P = 0.340$), but the second was showed a significant positive relationship ($P = 0.036$). Parasite species richness was not significantly related to dissolved oxygen concentration at either visit ($P = 0.293$ and 0.903). Our findings are important because nutrient pollution along our urbanization gradient could result in uncontrolled algae growth, reducing the dissolved oxygen in wetlands, which may be negatively impacting other species. Our study suggests that parasites could serve as water quality indicators, because as eutrophication increases there is more vegetation for snails to feed on thus greater reproduction, higher snail host abundance, and higher parasite transmission success. Future research should focus on particular species of parasites that may be the most reliable indicators.

15. Implantation of *Acanthocheilonema viteae* females pre-selected for high fecundity *in vitro* improves infection outcome in Mongolian jirds (*Meriones unguiculatus*). **ZACHARY HEIMARK (UG)**, Steven Schaar (T), Zach Williams (GS), Amy Hoechst (T), Laura Teigan (T), Michelle Michalski (MP). Department of Biology and Microbiology, University of Wisconsin, Oshkosh, WI 54901

The filarial nematode *Acanthocheilonema viteae* is maintained for the NIH/NIAID Filariasis Research Reagent Resource Center (FR3) at University of Wisconsin Oshkosh. In order to produce standardized infections for life cycle propagation, we require infected Mongolian gerbils to have parasitemias in the range of 100-300 microfilariae per 20 µL of blood. Because direct infection of jirds with injected L3s can induce fatal neuropathy, we typically surgically implant adult worms subcutaneously into the jirds, however resulting parasitemias are inconsistent and often do not reach adequate levels. Based on observations of high variance in microfilaria (MF) production by cultured adult female worms we hypothesized that the level of parasitemia developed by jirds after implantation with adult *A. viteae* is governed by fecundity of the worms at the time of implantation. In this experiment adult female *A. viteae* were individually cultured in NI media supplemented with 20% FBS. MF production for each worm was quantified after four days in culture and these numbers were used to classify each worm as having low (1 ± 1.2 mf), medium (12 ± 10.6 mf), or high fecundity (53 ± 35.2 mf). Six females from each group were combined with six adult males and implanted into recipient jirds; the parasitemia of each jird was determined after 30 days. Jirds implanted with low-producing worms had mean parasitemias of 37.5 ± 18mf/20 uL blood, medium-producing had 58.7 ± 40.5 mf/20 uL blood, and high producing 156 ± 38.2 mf/20 uL blood. One way ANOVA

revealed a significant difference between groups [F(2,6) = 10.52, p = .0109] and post hoc analysis using the Tukey's test demonstrated significant differences between the low-producing and medium-producing groups compared to the high-producing group; therefore the null hypothesis is rejected. These findings have a great impact on large-scale production of *A. viteae*, and parallel experiments aimed at improving production of *Brugia malayi*, a related human filarial parasite, are planned.

16. Finding three P's in a pond: Assessing the diversity of three plagiorchids in Midwestern wetlands. **ALMA G. MENDOZA (UG)**, ROBERT C. JADIN (MP), AND SARAH A. ORLOFSKE (MP), Department of Biology, Northeastern University, Chicago, IL 60625.

The Plagiorchioidea (plagiorchids) are a diverse taxonomic group of trematodes with a variety of lifecycles. Within this group, there has been extensive research focused on adult parasites in definitive hosts. A model group of plagiorchids is the genus *Haematoloechus*. The typical life cycle of *Haematoloechus* species includes snails as first intermediate host, odonates as second intermediate host, and amphibians as definitive host. However, studies have shown that adult morphology alone is not enough to determine the proper taxonomic place of some trematodes. New species of trematodes have been described using cercariae morphology; therefore, it is important to have both complete adult and cercarial trematode morphological descriptions to establish the placement of trematodes in the evolutionary tree of flatworms more accurately. The research objectives of this study were to combine morphological and molecular data to identify plagiorchid cercariae and investigate the diversity of parasites among first intermediate hosts from regional wetlands. Snails (e.g., *Helisoma* sp. and *Lymnaea* sp.) were collected from seven wetlands in northeastern Illinois and southeastern Wisconsin using D-frame dip-nets with a systematic sampling technique. The snails were shed for cercariae for 24 hours in both light and dark. Morphological data of cercariae were obtained using photographs taken on a Zeiss compound microscope at 10 or 20X magnification and measured using ImageJ software. A Bayesian phylogenetic analysis was conducted using sequence data from ITS 1 and ITS 2 gene fragments we generated from our specimens and previously published data from GenBank. Initially, we identified two morphotypes of cercariae: Armatae (lacking fin fold) within *Helisoma* sp. and *Lymnaea* sp. and Ornatae (with fin fold) within *Lymnaea* sp. Through molecular phylogenetic analysis, we found that our Armatae cercarial morphotype consisted of three genera: *Alloglossidium*, *Cephalogonimus*, and *Plagiorchis*. Similarly, the Ornatae morphotype consisted of two genera: *Haematoloechus* and *Glypthelmins*. Our Wisconsin field site had the

highest diversity of plagiorchids including four different genera: *Alloglossidium*, *Cephalogonimus*, *Glypthelmins*, and *Plagiorchis*. One of our Illinois sites had three different genera including *Glypthelmins*, *Haematoloechus* and *Plagiorchis* and our other Illinois site had two genera: *Alloglossidium and Plagiorchis*. However, useful morphological traits distinguishing genera within a particular morphotype are still required. In future studies, our cercarial morphological measurements can be combined with additional field surveys to create a robust morphological description of cercariae. The presence of these five plagiorchids in Midwestern wetlands indicates a potentially high diversity of free-living organisms because of the variety of life cycles represented involving diverse invertebrates, amphibians, and avian hosts. Similarly, the high diversity of parasites may play other roles in the community and ecosystem through effects on food web interactions.

17. Using gordiid cysts to discover the hidden diversity, potential distribution and new species of hairworms (Nematomorpha: Gordiida). **MATTHEW G. BOLEK**[1] **(MP)**, CLEO SZMYGIEL[1] (GS), RYAN P. SHANNON [1] (GS), MONICA PAPEŞ[1] (MP), ANDREAS SCHMIDT-RHAESA[2] (MP) and BEN HANELT[3] (MP), [1]Department of Integrative Biology, Oklahoma State University; [2]Zoological Museum and Institute, Hamburg, Germany. [3]Department of Biology, University of New Mexico.

One reason for the lack of knowledge on the diversity and distribution of hairworm species is the lack of reliable ways to collect adult free-living worms over large geographical areas. However, a recent study indicates that cyst stages of hairworms may be the most commonly encountered gordiid life stages in the environment and our previous work indicates that cyst stages can be used in generic and/or clade gordiid identification. These discoveries have given us the ability to investigate the biodiversity and distribution of these cryptic species of parasites. In this study, we sampled aquatic snails for the presence of hairworm cysts from 46 streams in Payne Co., Oklahoma. Using this modified survey procedure, gordiid cysts were found at 70 % (32/46) of sites examined throughout Payne Co., Oklahoma. Based on cyst morphology and/or arthropod host infections, we were able to identify three morphological types of gordiid cysts including *Paragordius*, *Gordius*, and *Chordodes*/*Neochordodes*. Using our gordiid cyst presence data in conjunction with environmental layers for Payne Co., Oklahoma, we developed an ecological niche model (ENM) using Maxent to identify areas suitable for snail infections with gordiids. The ENM for Payne Co., Oklahoma successfully predicted all presence localities of gordiid in snails over a geographical area of 1,810 km^2. Using this information along with sampling for adult free-living worms during peak emergent times in ENM predicted areas allowed us to discover a new species of gordiid. To our knowledge, this is the first ecological niche model attempted on such a small geographical scale (county level) that recovered known locations successfully. Our field data and ecological niche model clearly indicate that gordiid cysts are extremely common in the environment and this sampling technique can be useful in discovering new species of gordiids, even in relatively well sampled areas for these cryptic parasites.

18. Morphological asymmetry and habitat quality: using fleas and their rodent hosts as a novel experimental system. **ELIZABETH M. WARBURTON (PD)**, IRINA S. KHOKHLOVA (PI), DANIEL KIEFER (PD), and BORIS R. KRASNOV (PI). Mitrani Department of Desert Ecology, Jacob Blaustein Institutes for Desert Research, Ben Gurion University of the Negev, Midreshet Ben Gurion, Israel 8499000.

    Morphological asymmetry is widely used to measure developmental instability and higher levels of asymmetry often correlate with decreased mating success, increased inbreeding, increased stress, and decreased habitat quality. Links between asymmetry and environmental quality provide a novel context for host-parasite relationships because habitat a parasite experiences consists of host immunological and physiological processes. Parasites colonizing novel host species could therefore exhibit increased asymmetry due to decreased habitat quality. Our goal was to determine if asymmetry in fleas *Xenopsylla ramesis* and *Parapulex chephrenis* increased when their mothers were reared on species of rodents differing in their relatedness to the fleas' principal host. We found significant asymmetry in femurs ($F_{138, 556} = 3.652$, $p < 0.001$) and tibiae ($F_{138, 556} = 1.404$, $p = 0.004$) of *X. ramesis* but asymmetry was not affected by host relatedness. However, tibae of *P. chephrenis* exhibited significant asymmetry ($F_{109, 440} = 4.364$, $p < 0.001$) and asymmetry was highest in fleas whose mothers were reared on hosts that were distantly related to the principal host ($F = 2.726$, $df = 3$, $p = 0.048$). These results indicate that host species and, in turn, habitat quality significantly impacted asymmetry in *P. chephrenis*, a host specialist, but not *X. ramesis*, a more generalist flea. Therefore, fleas parasitizing multiple species may be better at compensating for developmental instability than host specialists when utilizing a novel host species. This suggests that host-switching events in host specialists may be constrained by the relatedness of the different host species in question.

19. Comparative trematode biota of healthy American coot and ring-necked duck harvested from Lake Winnibigoshish, MN. **TYLER ACHATZ (GS),**

TIMOTHY CHRISTOPHERSON (UG), RAINE MITCHELL (UG), CONNOR HUTTON (UG), MIRIAH LINVILLE (UG), OKHUMHEKHO KASSIM (UG), JACOB RACHUY (UG), and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

Parasitic surveys are important to gauge the normal parasitic biota within a population of hosts. Few survey studies have been conducted on the healthy parasitic biota of waterfowl in the midwestern United States recently. This study examined the trematode biota of apparently healthy American coot (*Fulica americana*) and ring-necked duck (*Aythya collaris*). Ten *F. americana* and 12 *A. collaris* were hunter shot and harvested from Lake Winnibigoshish, Minnesota in the fall of 2012, along with 7 *A. collaris* and 1 *F. americana* that were collected in spring of 2013. The intestines were extracted, rinsed, and examined for trematodes. Trematodes found were frozen for genetic analysis or fixed in formalin for morphological analysis. There were 8 trematode species found in *F. americana* and 10 were found in fall *A. collaris*. There were 2 trematode species found in both *F. americana* and *A. collaris*. These were *Zygocotyle lunata* and *Sphaeridiotrema pseudoglobulus*. Three trematodes associated with waterbird mortality events were also identified. They are *Leyogonimus polyoon*, *Cyathocotyle bushiensis, S. pseudoglobulus*. *L. polyoon* was found only in *F. americana* and had the greatest intensity of all trematodes found. This study provides a baseline description of the normal parasitic biota found in *F. americana* and *A. collaris* in north central Minnesota.

20. Identification of new species *Neopsilotrema itascae* n. sp. and reclassification of *Psilotrema mediopora* to *Neopsilotrema mediopora* n. comb. **TYLER ACHATZ (GS)** and ROBERT SORENSEN, Ph.D. (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

Neopsilotrema itascae n. sp. is an avian psilostomid digenean found within the anterior small intestine of *Aythya affinis* in North America. The larger *Neopsilotrema lisitsynae* specimens and *Psilotrema* share a morphological overlap with *N. itascae*; however, *N. itascae* n. sp. differ from other members of *Neopsilotrema* with the presence of prominent vitelline ducts, which extend to the level of the ventral sucker before returning posterior to the Mehlis gland, a larger anterior seminal vesicle, a sub-spherical shape of the testes, and thinner, lateral vitelline bands. Sequences of 28S ribosomal DNA (rDNA) sequences were effective to identify species. Two nucleotides were found to differ from the closest genetic relatives, *N. lisitsynae* and *Neopsilotrema lakotae*. Further, *N. itascae* n. sp. differs from

P. mediopora in the number and size of eggs, as well as having more elongate, and larger gonads. Additionally, scanning electron microscopy was utilized to confirm tegumental texture and additional ultrastructure analysis. *P. mediopora* was originally placed within *Psilotrema* due to the presence of tegumental spines and ventral sucker that is smaller than the oral sucker. The recently described genus *Neopsilotrema* provides a better match for *P. mediopora* than its original placement in *Psilotrema* due to the shared location of the genital pore, similar sucker sizes, the presence of body spines, similar egg size and number, and the relative length of post-testicular fields. *P. mediopora* was originally described with a unipartite seminal vesicle, but studies by Besprozvannykh (2003, 2007) utilizing a variety of *Psilotrema* species from Oschmarin's (1963) collection described individuals of the genus to have bipartite seminal vesicles. The morphological similarity to *Neopsilotrema* and doubt over the nature of the unipartite seminal vesicle lends support to the transfer of *P. mediopora* from *Psilotrema* to *Neopsilotrema*.

21. Observations on the life history of *Gordius* cf. *robustus* (Nematomorpha: Gordiida) from Oklahoma. Is this the first documented semi-terrestrial hairworm life cycle? **CHRISTINA ANAYA (GS)***[1], Ben Hanelt[2] and Matthew G. Bolek[1]. [1]Oklahoma State University. [2]University of New Mexico.

Freshwater gordiids have complex life cycles which include multiple hosts and a free-living aquatic phase. In North America one of the most commonly encountered gordiid species is *Gordius robustus*. However, a recent molecular study indicates that *Gordius* cf. *robustus* is comprised of at least 8 different species, and little is known about the general biology and life cycles of these species. To increase our knowledge on the biology of this newly discovered complex of gordiids, we investigated the seasonal occurrence, morphology, and life history of *Gordius* cf. *robustus* from Oklahoma. Adult hairworms were collected in puddles from lawns and road gutters in Stillwater, Payne County, Oklahoma. Habitats were surveyed throughout the year, but all free-living worms were found during rain events from November 2014-March 2016. Although hundreds of worms could be observed during rain events, no arthropod hosts were ever observed. In the laboratory, after mating, females laid eggs which contain a double membrane. Larval morphology was characteristic for the genus *Gordius*. Although egg strings were never observed in the field, surveys of earthworms and land snails indicated that they were commonly infected with *Gordius* type cysts suggesting that gordiid larvae also occur in a terrestrial environment. Additionally, scanning electron microscopy observations of *G*. cf. *robustus* from Oklahoma indicate that although the cuticle is variable among individual worms, this species is distinct in its morphology from other described North American species in the genus *Gordius*. From these observations, we hypothesize that this species may represent the first documented hairworm with a semi-terrestrial or terrestrial life cycle.

22. Analysis of humoral immune responses in horses with equine protozoal myeloencephalitis. **KATY-JANE ANGWIN (GS)** and DANIEL HOWE (MP), M.H. Gluck Equine Research Center, Department of Veterinary Science, University of Kentucky, Lexington, KY 40546.

Equine protozoal myeloencephalitis (EPM), caused by the protozoan parasite *Sarcocystis neurona,* is one of the most important neurological diseases in horses in the Americas. While the seroprevalence of *S. neurona* in horses is high, clinical manifestation of EPM occurs in less than 1% of the infected horses. Clinical signs of EPM can vary, and antemortem diagnosis has proven challenging as the presence of serum antibodies against *S. neurona* is an indicator of infection but not necessarily disease. Factors governing the occurrence and severity of EPM are largely unknown, although horse immunity might play an important role in clinical outcome. Immunoglobulin G is the predominant antibody class in equine serum and consists of four subisotypes - a, b, c, and (T). IgGa and IgGb are thought to be indicative of a type I, cell-mediated immune response, and isotypes IgGc and IgG(T) are thought to be indicative of a type II, humoral immune response. We hypothesize that EPM occurs due to an aberrant immune response, which will be discernable in the IgG subisotypes that recognize *S. neurona* in EPM horses versus infected but unaffected horses. We have modified an existing ELISA to quantitate the amount of *S. neurona*-specific IgG and sub-isotypes a, b, and (T) in equine serum. Based on previously-established serum antibody concentrations for total IgG and subisotypes in healthy horses, standard curves have been generated from a pooled serum sample of 21 healthy horses. The standard curves then serve to establish the amount of antigen-specific total IgG and IgG subisotypes a, b, and (T) in equine serum samples. The IgG concentrations in sera from EPM horses will be compared to sera from seropositive but normal horses to assess whether neurologic disease is associated with detectable differences in the antibody response elicited by infection.

23. Genetic & morphological description of echinostomatids taken from waterfowl at Lake Winnibigoshish, Minnesota. **DANA BENNETT (UG)**, TYLER ACHATZ (GS), and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

Echinostomatids (Digenea: Echinostomatidae) are common parasitic flatworms of birds and other vertebrates. Many echinostomatids have complex life cycles with indistinguishable morphological characteristics which may vary by collection region. However, cryptic echinostomatids are distinguishable through diagnostic genetic sequencing of ribosomal and mitochondrial DNA. Unfortunately, many studies examine genetics of echinostomatids, while ignoring diagnostic morphological data. This study utilized both genetic and morphological data in order to validate species identifications and elucidate genetic and morphological variation previously unreported. Echinostome parasites were collected from a variety of waterbirds in fall 2012 and spring 2013. DNA from these worms was amplified via PCR to sequence the 28S, ITS, ND1, and CO1 of regions of nuclear and mitochondrial DNA. Sequences were processed using Basefinder & 4Peaks software. MEGA6 software was used to generate phylogenies of each locus. The results showed 3 distinct *Echinoparyphium* species: *Echinoparyphium speotyto*, *Echinoparyphium recurvatum,* and an unknown 39-spined *Echinoparyphium sp*. Adult and juvenile *Echinoparyphium* individuals have been described as cryptic due to highly convergent body forms along with indistinct juveniles in definitive hosts. Adult morphology supported differentiation between the 3 species, however, the juveniles only differed in the number of collar spines, an easily destroyed body feature. Mitochondrial DNA of *E. recurvatum* from fall and spring collected birds showed variation at both CO1 & ND1 indicating distinct lineages.

24. Genetic and morphological description of *Leyogonimus polyoon* (Trematoda: Leyogonimidae) harvested from *Fulica americana* of Lake Winnibigoshish, Minnesota. **DANA BENNETT (UG),** TYLER ACHATZ (GS)**,** and ROBERT SORENSEN (MP), Department of Biological Sciences, Minnesota State University, Mankato, MN 56001

Leyogonimus polyoon has been associated with bird die-offs in North America effecting American coot (*Fulica americana*). Unfortunately, there have been limited investigations of morphological features of the species since Linstow's initial description in 1887, and there are currently no published sequences of DNA available. *Leyogonimus polyoon* individuals of the current study were harvested from the American coot of Lake Winnibigoshish, Minnesota. Specimens of this study were highly polymorphic, but most contained clear distinguishing features of available from *L. polyoon* descriptions. With the utilization of 28S rDNA, the closest related genus was found to be *Allassogonoporus*, which is also member of the Order Plagiorchiida, with 4.1% divergence being detected between the two species. No genetic variation was detected in the 28S rDNA sequences

between *L. polyoon* isolates. Several isolates of varying morphotypes were compared to one another at a more variable locus in the cytochrome c oxidase gene (CO1) supporting a unified species. This is the first detailed morphological and genetic description of *L. polyoon* collected in American coot in North America.

25. The Helminths of the Short-tailed Cane Mouse, *Zygodontomys brevicauda* (Rodentia: Cricetidae) in French Guiana. **HAYLEY FALAT (UG)** and F. AGUSTÍN JIMÉNEZ (MP), Department of Zoology, Southern Illinois University, Carbondale, IL 62901

Zygodontomys brevicauda, or the short-tailed cane mouse, is a small sigmodontine rodent common to herbaceous groundcover of the savannas and pastures of northern South America including French Guiana, Brazil, Colombia, Costa Rica, Panama, Venezuela, and Trinidad. This mouse is nocturnal, terrestrial and omnivorous and is common in anthropogenic landscapes. *Zygodontomys brevicauda* is the natural reservoir for the Guanarito Virus (Arenaviridae), which is responsible for hemorrhagic fever. The goal of this manuscript is to inventory the metazoan parasites of *Z. brevicauda* to enable testing of the synergistic effects, if any, of metazoans and the Guanarito Virus. Necropsies were performed on the complete digestive tracts of fourteen rats collected in French Guiana to determine what parasites were present in each individual examined. The number of the parasites and their location within the digestive tract was catalogued and individual specimens were processed for identification. The helminths collected include *Syphacia* sp., *Heterakis spumosa*, *Hassalstrongylus* sp., and an unidentified tapeworm, all found in the digestive tract. The filaroid worms *Litomosoides* sp., were found in the peritoneal tissues. Ninety-three percent of the individuals were infected with at least one species, with an average number of 27 worms per short-tailed cane mouse. This study provides the first characterization of infections suffered by *Z. brevicauda.*

26. Detection of *Borrelia*, *Ehrlichia*, and *Rickettsia* spp. in Ticks in Adair County of Northeast Missouri. **D. A. HUDMAN (RA)** and N. J. SARGENTINI (TF)**.** Department of Microbiology & Immunology, A.T. Still University, Kirksville, MO 63501

The most common ticks in Missouri, all of which are associated with human pathogen transmission, are the lone star tick (*Amblyomma americanum*), American dog tick (*Dermacentor variabilis*), and the black-legged tick (*Ixodes scapularis*). Ticks are especially common in Northeast Missouri, but poorly studied despite the fact that Missouri is one of five

states that accounts for over 60% of all Rocky Mountain spotted fever cases and one of three states that accounts for 30% of all reported *E. chaffeensis* infections. We conducted this research to improve our understanding of tick populations and tick-borne pathogen presence. Actively questing ticks were collected using a tick drag-flag method and by carbon dioxide traps. Ticks were identified and pooled by species and life stage (adults = 5; nymphs = 25, larvae = 100). Tick pools were tested for the presence/absence of *Borrelia* spp.*, Ehrlichia spp.,* and *Rickettsia* spp. using polymerase chain reaction (PCR). All positive reactions were confirmed by a second round of PCR and representative positive PCR products were purified and sent off-site for sequence verification. A total of 15,162 ticks were collected, of which 13,980 were grouped in 308 pools. Infection rates were calculated as the maximum likelihood estimation (MLE) with 95% confidence intervals (CI). Of the 308 pools tested, 229 (74.4%) were infected with bacteria and the overall MLE of the infection rate per 100 ticks was calculated as 2.9% (CI 2.6-3.2). Infection rates varied among life stages, 28.6% (CI 24.0-34.0) in adults, 7.0% (CI 5.1-9.9) in nymphs, and 0.95% (CI 0.8-1.2) in larvae. In the 116 adult lone star pools, infection rates for *Borrelia*, *Ehrlichia*, and *Rickettsia* spp. were 4.3%, 13.2% and 19.1%, respectively. In the 52 nymph lone star pools, infection rates for *Borrelia*, *Ehrlichia*, and *Rickettsia* spp. were 1.6%, 2.4% and 2.7%, respectively. In the 20 adult American dog tick pools, the infection rate for *Ehrlichia* spp. was 18.3%. We have performed the first in-depth survey of ticks and tick-borne human disease in Northeast Missouri. We not only determined the presence of *Borrelia*, *Ehrlichia* and *Rickettsia* species, but have also implicated high prevalence. One novel finding was the presence of *E. chaffeensis* and *E. ewingii* in five of the 120 lone star larvae pools, which is suggestive of transovarial transmission.

27. Does sex or age affect infection levels in mice? **ASHLEY HUETTE (UG)** and SHAWN MEAGHER (MP), Biological Sciences, Western Illinois University, Macomb, IL 61455

Parasites harm their hosts, and because of this, can potentially reduce host population size. Parasite epidemiology is the study of the factors that determine host infection. Two factors that could affect infection levels are sex and age because testosterone may increase infection susceptibility in males, and older hosts may accumulate parasites over time. I evaluated the effects of host sex and age on infection by the nematode, *Pterygodermatites peromysci,* in the common and widespread white-footed mouse, *Peromyscus leucopus.* This worm has been shown to reduce reproductive output (and potentially population size) of this host. I trapped 113 mice over 3 days at Kibbe Life Sciences Station during July 2015. Sex was determined by gonad examination. Age was determined by mass: mice ≤ 20 grams were classified as "subadult," and those > 20 grams, "adult." The gastrointestinal track was examined for *P. peromysci*. I calculated "prevalence," the fraction of hosts infected in the sample, and "intensity," the number of worms per infected host. For all mice, prevalence was 0.32 (95% C.I. 0.24–0.42) and intensity was 1.97 (1.61–2.53) worms per host. There was no effect of sex on prevalence (Fisher's exact test: p=0.84) or intensity (bootstrap 2-sample t-test: p=0.56). There was also no effect of age on prevalence (p=0.64) or intensity (p=0.78). These results contrast with a previous study of these animals in the Appalachians. There, sex also had no effect on infection, but age did: older mice had more worms. Thus, details of infection with *P. peromysci* vary geographically

28. Improving transfection efficiency in the apicomplexan parasite *Sarcocystis neurona*. **EMILY LEBEAU (GS)** College of Veterinary Medicine, Lincoln Memorial University, Harrogate, TN 37752; DANIEL HOWE (MP) and MICHELLE YEARGAN (T), Gluck Equine Research Center, Department of Veterinary Science, University of Kentucky, Lexington, KY 40546

Sarcocystis neurona is the primary cause of equine protozoal myeloencephalitis (EPM). Further study of this parasite to better understand its biology will improve our ability to control infection and disease in the horse. Molecular genetic capabilities (i.e., nucleic acid transfection) make possible a variety of experimental approaches, including gene knockouts, complementation experiments, and gene regulation assays. Methods and tools have been established for molecular genetic manipulation of *S. neurona*. However, transfection efficiency remains quite low (2-3%) compared to other apicomplexan parasites such as *Toxoplasma gondii* (25%+), which hinders our ability to use these molecular tools effectively. It is the goal of this research to improve transfection efficiency in order to enhance the use of these molecular genetic tools to study *S. neurona*. Different electroporation systems and settings will be compared to determine what method is best to efficiently introduce exogenous nucleic acid into *S. neurona*. Efficiency will be measured by transfecting culture-derived merozoites with a plasmid containing the yellow fluorescent protein (YFP) gene driven by the SnSAG1 promoter. Transfected parasites will be inoculated onto coverslips of BT host cells, and then fixed and visualized by epifluorescence microscopy after 3 days of growth. Transfection efficiencies will be determined from the total number of parasites compared to the fraction expressing the YFP reporter gene. Greater transfection efficiency will improve our capabilities to perform

molecular manipulations of *S. neurona* looking into gene regulation and protein function.

29. Inter- and Intra-clonal Comparisons of *Schistosoma mansoni* Cercariae. **SARAH MARSHALL (UG)**, Department of Biology, Purdue University, West Lafayette, IN 47906

Schistosoma mansoni is a human parasite that causes schistosomiasis, a tropical disease impacting over 230 million people worldwide. Each life cycle of the parasite includes sexual and asexual proliferation. Previous research indicates that the genomes of parasites resulting from asexual proliferation are non-identical. It has been suggested that mitotic recombination events during sporocystogenesis creates this heterogeneity in clonal cercariae. Repeats such as transposable elements (TEs) are seemingly responsible for creating such recombinations. Transposable elements are mobile repetitive DNA segments that generate genomic plasticity. In order to test the role of TE's in clonal line variation, we mono-infected snails to generate clonal cercarial lines, separated the cercariae into males and females, extracted DNA from 10 replicates of each clonal line, and quantified TE copy numbers of the cercariae using qPCR. We hypothesized that mitotic recombinations would create greater copy number variation within individual clonal populations than the average copy number between the different clonal populations. This is because while the variation within a single clonal population should be high, it should average out to be similar to the other clonal populations. We ran the qPCR on three TEs (Saci1, Perere, and Merlin) and used an internal control gene, GAPDH, to compare the copy numbers among the cercariae. Our results indicate there is high variation in TE copy number within each clonal line, and no significant differences between clonal lines, indicating that TEs may be responsible for the non-identical nature of these sexually reproduced stages

30. Does fire affect parasitism in midwestern white-footed mice? **JANIE MILLER (UG)** and SHAWN MEAGHER (MP), Biological Sciences, Western Illinois University, Macomb, IL 61455

Parasites are organisms that live either on or inside a host. Parasites can reduce individual host reproduction or survival, and as a result, have important impacts on host population size. In order to understand how parasites affect host individuals and populations, we must determine what regulates parasite infection levels. Environmental factors can have important effects on levels of parasitism. In the external environment, factors such as temperature and humidity affect egg survival: hot, dry

environments can kill eggs. Reduced forest cover leads to temperature increases and humidity decreases. A common, major cause of reduced forest cover is fire, but with respect to parasitism, there is little information gathered on how the two are related. A handful of studies have examined the effects of fire on parasitism. From these studies, there is no clear correlation between parasitism and fire. To test for a general pattern, I will collect data in a new location, Midwestern oak forest, to determine whether fire affects parasite abundance in white-footed mice (*Peromyscus leucopus*). White-footed mice will be trapped at Kibbe Life Science Station using traps in burned and unburned plots. Mice will be euthanized and dissected. Parasites will be stored in vials and preserved. We will identify all external parasites, as well as internal parasites because both types have environmental stages that can be negatively impacted by fire. Generalized linear models (GLMs) will be used to determine whether mouse sex, size, or forest fire affect the abundance of external, internal or both, types of parasites.

31. New Distribution Records, Molecular Data And Review Of The Genus *Hepatozoon* (Apicomplexa: Adeleorina) Infecting North American Anurans. **RYAN P. SHANNON (GS)** and MATTHEW G. BOLEK (MP), Department of Integrative Biology, Oklahoma State University, Stillwater, OK.

Of all the studies on anuran parasites, the adeleorine coccidia are perhaps the most poorly studied group of parasites of anurans. Within the adeleorine, the genus *Hepatozoon* Miller, 1908 has been documented in the erythrocytes of frogs worldwide. Of the 5 North American *Hepatozoon* species infecting anurans, *H. catesbianae* and *H. clamatae*, have been reported on multiple occasions infecting bullfrogs (*Rana catesbianae*) and green frogs (*Rana clamatans*) in Eastern North America. However, no accounts exist for these species west of Illinois. The 2 species are morphologically similar, but can be distinguished by the effect of the gametocyte on the host erythrocyte nucleus. Infections with *H. clamatae* distort and fragment the erythrocyte nucleus; whereas *H. catesbianae* infections do not. In a survey of blood protozoans of 9 species of amphibians from Oklahoma, *Hepatozoon* gametocytes were found in (2/70) *R. sphenocephala* and (2/28) *R. catesbeiana* by examination of Giemsa stained blood smears with a compound light microscope. Ten *Hepatozoon* gametocytes infecting erythrocytes were measured from each infected individual and compared to previously reported morphometric data for all North American species of anuran *Hepatozoon*. Additionally, the 18s and ITS-1 rRNA genes were sequenced from 2 infected individuals, the sequences were aligned with sequence data for *Hepatozoon* spp. on

GenBank and a phylogeny was created using a maximum likelihood framework. The *Hepatozoon* sp. from this study was morphologically similar to *H. catesbianae*. Based on this characteristic and a close phylogenetic association to previously reported *H. catesbianae* sequences, we report a new locality for *Hepatozoon* cf. *catesbianae* in Oklahoma, extending the known range for the species by at least 1800 km.

32. Cytokine response of human THP-1 macrophages to *Trichomonas tenax* (Trichomonadida: Trichomonadidae). EMILY J. GOVRO (MS) and **MELISSA K. STUART (MP)**, Department of Microbiology/Immunology, A.T. Still University of Health Sciences, 800 W. Jefferson St., Kirksville, Missouri 63501.

Trichomonas tenax is a protozoan that inhabits the oral cavity of humans, most often those with poor oral hygiene. Although *T. tenax* is widely considered a commensal, recent studies have suggested a pathogenic role for the protozoan in persons with periodontitis. Here we investigated the capacity of *T. tenax* to induce pro-inflammatory cytokine secretion in human macrophages, with the idea that elicitation of inflammation may be one mechanism by which *T. tenax* contributes to oral pathology. Human THP-1 cells differentiated to the macrophage phenotype were incubated with live or sonicated *T. tenax* at macrophage:trophozoite ratios of 5:1, 10:1, and 20:1. Culture media removed from the wells after 4, 8, and 16 h of stimulation were assayed by ELISA for tumor necrosis factor alpha, interleukin-1 beta, interleukin-8, and the immunoregulatory cytokine interleukin-10. Live *T. tenax* trophozoites failed to induce production of any of the cytokines tested, regardless of macrophage:trophozoite ratio or length of co-incubation. *T. tenax lysates* stimulated interleukin-8 synthesis, but only after 16 h of incubation at the 5:1 macrophage:trophozoite ratio. These results suggest that pro-inflammatory cytokine synthesis by human macrophages in direct response to *T. tenax* contributes little to oral pathology.

33. Observations on the Morphological Characteristics of Adult *Sphaeridiotrema pseudoglobulus* from Lake Winnibigoshish. **Lindsay Strommen* (UG), Madison Teasley* (UG),** Scott Malotka (GS), & Robert Sorensen (MP), Department of Biological Sciences, Minnesota State University Mankato, Mankato MN 56001

Studies of *Sphaeridiotrema,* a highly diverse trematode genus that is known to infect the gastrointestinal tract of waterbirds, have noted differences not only in the morphology of its members but also in the pathologies that they cause. *Sphaeridiotrema pseudoglobulus* and *S.*

globulus, for example, have been successfully differentiated by morphology using egg size, with the former species bearing significantly larger eggs than the latter. Pathologically, only *S. globulus* is fatal in waterfowl, causing hemorrhagic enteritis, although *S. pseudoglobulus* can still cause disease in these birds when in large enough numbers. Given that the morphology of *S. pseudoglobulus* is relatively underexplored in the waterfowl frequenting Lake Winnibigoshish in northern Minnesota, the current study was undertaken. Specifically, this investigation aims to verify that different species of waterfowl (*i.e.*, blue-winged teal, lesser scaup and redhead) collected from Lake Winnibigoshish were in fact infected with *S. pseudoglobulus* based on morphological characteristics. Another goal of this work was to examine the variation in morphological measurements of adult *S. pseudoglobulus* and compare these findings to other previously published data. Overall, number of eggs present per worm displayed a range of 1-9 eggs per individual. Interestingly, the size of eggs was smaller than previous studies on *S. pseudoglobulus* which may indicate difficulties in morphological identification between species of this genus.

34. Giant liver fluke in North American cervids: just a fluke? **J. TREVOR VANNATTA (GS)** and RON MOEN (MP), Natural Resources Research Institute, University of Minnesota, 5013 Miller Trunk Highway, Duluth, MN 55811

Fascioloides magna, the giant liver fluke, is a potential contributing factor to moose mortality across North America. Although the effect of this parasite on moose populations is debated, there is little evidence that *F. magna* infection alone will cause mortality. However, *F. magna* prevalence is increasing, and the additional parasite burden may be important in combination with other factors. Therefore, an understanding of *F. magna*'s biology is needed when working with moose and other cervids in North America. *F. magna* requires a snail, plant, and cervid host to complete its life cycle, but which snails are most important for *F. magna* transmission and the habitat requirements of these snails are not well understood. Snail hosts must overlap with cervid feeding or drinking in aquatic habitats for transmission of *F. magna* to occur. Habitat use, population density, and age structure of sympatric deer and elk likely contribute to infection risk for moose. Examining the energetic cost and fitness losses associated with *F. magna* infection, followed by a comprehensive risk assessment using known habitat requirements of *F. magna*, lymnaeid snails, and cervid hosts would elucidate the risks and impacts of *F. magna* in North America

35. Natural and Experimental Infections of *Daubaylia* sp. in *Helisoma trivolvis* and other Freshwater Snails. KYLE D. GUSTAFSON (GS), LUKE BALL

(UG) and **MATTHEW G. BOLEK (MP)**, Department of Integrative Biology, Oklahoma State University, Stillwater, OK.

Nematodes in the genus *Daubaylia* are known to parasitize planorbid snails and can exhibit major effects on snail survival and reproduction. As a result, they have been implicated as biocontrol agents for disease-vector snails, specifically for *Biomphalaria glabrata*, which is a major vector of *Schistosome* spp. However, little is known about *Daubaylia* spp. in nature, their host specificity, and their effects on various snail hosts. In the field, we surveyed *Helisoma trivolvis* snails for *Daubaylia* sp. infections. In the laboratory, we exposed individual snails from four species of laboratory-reared snails (*Biomphalaria glabrata, Helisoma trivolvis, Physa acuta, and Stagnicola elodes*) to freshly-shed *Daubaylia* sp. nematodes from wild-caught *Helisoma trivolvis* snails. Additionally, in aquaria, we exposed the same snail species to *Helisoma trivolvis* snails that were presently shedding *Daubaylia* sp. nematodes. Based on those results we exposed individual snails (laboratory-reared *Biomphalaria glabrata* and *Helisoma trivolvis*) to 0, 5, 10, 20, or 40 nematodes and recorded prevalences, infection intensities, and host snail survival. Our results indicate that *Daubaylia* sp. is specific to planorbid snails. Host survival decreased with increasing nematode exposure dose. Lastly, *Daubaylia* sp. tended to successfully reproduce in snails when snails were given lower nematode exposure doses whereas fewer worms were observed in snails given higher nematode exposure doses. This suggests there is either completion among worms or the host is negatively affected in such a way that higher infections reduce habitat quality for the nematodes.

36. DNA barcoding reveals two distinct species of white grub in green sunfish.
TORI WORTHEN (UG) and **SHAWN MEAGHER (MP)**, Biological Sciences, Western Illinois University, Macomb, IL 61455

Estimating parasite species diversity is important for understanding biodiversity. However it can be difficult, due to the existence of morphologically identical but genetically distinct "cryptic species." In Spring Lake, IL, game fishes are infected with "white grub" (*Posthodiplostomum minimum*), and two distinct sizes of worms occur in green sunfish (*Lepomis cyanellus*). I used DNA "barcoding" to determine the number of white grub species that infect green sunfish. I collected eleven green sunfish by electroshocking. Worms were removed from host livers and measured to the nearest 0.1 mm. Sequences of mitochondrial cytochrome oxidase I (COI) were determined for 26 worms at the Canadian Centre for DNA barcoding (CCDB). Pairwise genetic distances were calculated between all sequences and used to construct a neighbor-joining

(NJ) tree. I used a BLAST search to identify the species of each distinct group. The NJ revealed two genetically distinct groups. Mean genetic distance within groups was 0.008, and between groups was 0.177. BLAST determined that one of the clusters was "Locke sp. 3," while the second cluster was "Locke sp. 2," both from *L. gibbosus* (pumpkinseed sunfish). Size differed significantly between the two types (t=5.58. df =23, p < 0.001); the mean (± variance) for sp. 3 was 0.83 (± 0.049) and for sp. 2 was 0.50 (± 0.006). These results suggest that green sunfish are infected by two similar, but genetically distinct, species. Since *P. minimum* infects >20 different centrachid hosts, more data are needed to accurately determine species number in this group.

37. *In silico* analysis of the structure of putative *daf-16* homologues of *Hymenolepis diminuta* and *H. microstoma*. KATHERINE E. HOLLERAN (UG), KAITLIN P. ESSELMAN (UG) and **DOUGLAS B. WOODMANSEE (MP)**, Department of Biology, Wilmington College, Wilmington OH 45177.

The tapeworm *Hymenolepis diminuta* has been shown to have an extremely long life span. In light of this, we thought the species might be an interesting new model for life span extension research. Blockade of the insulin/IGF-1 signaling (IIS) pathway of *Caenorhabditis elegans* extends the life span of these free-living nematodes by a factor of two. We wondered if there might be novel features in the *H. diminuta* IIS pathway that would explain the tapeworm's longevity. The last protein in the *C. elegans* IIS pathway is DAF-16, a FoxO transcription factor that regulates the expression of a large array of other proteins. IIS signaling results in phosphorylation and subsequent inactivation of DAF-16 which in turn results in down-regulation of multiple proteins that, among other effects, extend life span. We have used *in silico* approaches to identify and examine the putative *daf-16* homologues of *H. diminuta* and the closely related *H. microstoma*. We also used RT-PCR to verify *in vivo* transcription of the genes. We found that both tapeworm *daf-16* homologues encode a 93 amino acid extension to carboxyl end of the protein but fail to encode one of the three phosphorylation sites by which the IIS pathway inhibits DAF-16 function. It is possible that the missing phosphorylation site reduces the sensitivity of tapeworm DAF-16 to IIS pathway activation, thus extending worm life span.

SUMMARY OF THE 67TH ANNUAL MIDWESTERN CONFERENCE OF PARASITOLOGISTS.

The 67th Annual Midwestern Conference of Parasitologists was held on July 9-11, 2015, at Lawrence University in Appleton, WI. Dr. Trudy Aebig of Miami University served as Presiding Officer and Dr. Judith Humphries of Lawrence University made local arrangements and served as Program Officer. Forty-eight persons registered for the conference. Nine platform presentations and 11 posters were presented. The C. A. Herrick Award and $300 for outstanding poster was awarded to Justin Wilcox from University of Notre Dame for his poster "Temporal and Spatial Variation in the Protozoan Parasite Community of Singapore's Long-Tailed Macaques (*Macaca fascicularis*)." The G. R. LaRue Award and $300 for outstanding platform presentation was awarded to Elliot Zieman of Southern Illinois University for his presentation "*Cytauxzoon felis* (Apicomplexa: Theileriidae) in bobcats, domestic cats, and tick vectors in the southern region of Illinois." Erik Rodriguez and John Lopez from University of Notre Dame were awarded the R. M. Cable undergraduate award and $200 for their presentation "Provisioning Pollution in the Population Genetics of *Blastocystis* in Bali's Long Tailed Macaques." Honorable Mention awards (and $100) were given to Heather Toman of Northern Michigan University for her poster entitled "Comparative phylogeography of North American pika parasites" and Evan Boone of Eastern Illinois University for his presentation "White Grub in Centrarchidae from the Ohio River Drainage." All of the students who won awards are invited to claim an additional $200 to support travel to another scientific meeting before the next AMCOP. Elliot Zieman was chosen as the AMCOP nominee for the American Society of Parasitologists' student travel grant award for 2015.

The AMCOP symposium was presented by Dr. Rebecca Cole, of the USGS National Wildlife Health Center who spoke on "Wildlife health, invasive species and trojan horses" and Dr. Shelly Dubay, from University of Wisconsin-Stevens Point who spoke on "Wildlife-parasite research with undergraduates - 3 recent projects." The banquet speaker was Dr. Shelly Michalski, of University of Wisconsin-Oshkosh who spoke on "*Acanthacheilonema viteae* as a research model and 'tick on tick' violence"

AMCOP 68 will be held in 2016 at Southern Illinois University, Carbondale, IL. Additional future meeting sites as determined by the Meeting Sites Committee:

AMCOP 69 – 2017: Wilmington College, Wilmington OH
AMCOP 70 – 2018: Eastern Illinois University, Charleston, IL

AMCOP 71—2019: Minnesota State University Mankato, Mankato, MN
AMCOP 72—2020: St. Norbert College, DePere, WI

Secretary-Treasurer Sorensen was unable to attend this meeting. In his absence, Dr. Kim Bates presented the treasurer's report for 2014 and the interim financial report for 2015. These reports were approved.

The AMCOP Student Research Grant Committee (Dan Howe (Chair), Ron Rosen, Tom Platt, Jeff Laursen, and Doug Woodmansee) reported its decisions for the AMCOP-sponsored research grants. The awardees are: Ashley Huette, Western Illinois University, "Does fire affect parasitism in Midwestern mice?" ($250); Alma Mendoza, Northeastern Illinois University, "Finding three P's in a pond: Assessing the diversity of three plagiorchids in Midwestern wetlands" ($250); Lauren Maestas, University of South Dakota, "Rocky Mountain Spotted Fever: Spotted Fever group Rickettsiosis in Lower Brule, South Dakota." ($500).

The following committee reports were received and approved: Auditing (Tom Platt, Timothy Yoshino), Awards (Doug Woodmansee, Tim Yoshino), Meeting Sites (Sarah Orlofske, Anindo Choudhury), Nominating (Kim Bates, Laura Teigen), Resolutions (Jeff Laursen, Shelly Michalski), and Symposium Suggestions (Augustín Jiménez, Natalie Dinguiràrd).

The annual silent auction was also held and sale of the 34 donated items raised $220 to support future AMCOP activities.

The report of the Resolutions Committee was well received and included thanks to many including Elanco Animal Health, a division of Eli Lilly Company, for its continued support of the C.A. Herrick Award for the outstanding poster presentation, and to the American Society of Parasitologists for their continued support in providing the student travel grant award.

Officers elected for 2016 were: Dr. Matt Brewer, Iowa State University: Presiding Officer; Dr. Agustín Jiménez, Southern Illinois University: Program Officer; Dr. Robert Sorensen, Minnesota State University Mankato: Secretary-Treasurer.

Prepared April 24, 2016
Robert Sorensen
AMCOP Secretary-Treasurer

THE ANNUAL MIDWESTERN CONFERENCE OF PARASITOLOGISTS (AMCOP)

OBJECTIVES AND ORGANIZATION

A restatement to incorporate changes approved in 1989. Earlier statements have been approved in 1948, 1953, 1971, 1972, 1973, 1974, 1986, 2003 and 2004.

NAME

The organization shall be known as the ANNUAL MIDWESTERN CONFERENCE OF PARASITOLOGISTS (AMCOP), hereinafter referred to as the Conference.

AFFILIATION

The Conference is an affiliate of the American Society of Parasitologists.

OBJECTIVES

The Conference is a gathering of parasitologists and students of parasitology for the purpose of informal discussion of research and teaching in parasitology and the furthering of the best interests of the discipline of parasitology.

MEMBERS

The Conference is open to all interested persons regardless of place of work, residence, or affiliation in other recognized societies. There are three categories of membership: Emeritus, Regular, and Student. When a member retires from industry, university or other professional occupation, that person shall be eligible for emeritus membership.

DUES

Annual dues are required for emeritus, regular and student membership. A registration fee is charged during registration at annual conferences. The amount of this fee will be decided for each Conference by a committee composed of the Presiding Officer, the Secretary/Treasurer, and the Program Officer, who is to serve as its chair. Dues are established by the Policy Committee and collected by the Secretary/Treasurer.

MEETINGS

The Conference is held in the general Midwestern area during early to mid-June, unless otherwise specified by a majority vote of the previous Conference or a majority vote of those listed members replying by mail.

BYLAWS

1. Simple majority vote of members in attendance at regularly scheduled meetings of the Conference shall determine the policies of the Conference.

2. The officers are a Presiding Officer, whose term of office is one year or until a successor is elected (normally the term expires with adjournment of the annual Conference over which the person presides); a Secretary/Treasurer, whose term of office is two years or until a successor is elected; a Program Officer whose term of office is one year; and a Policy Committee composed of the last five available retired Presiding Officers plus, *ex officio* and without vote, the current Presiding Officer and Secretary/Treasurer. All terms of office of each full member of the Policy Committee is five years, or so long as the person is one of the five most recent, available Presiding Officers. The most recent past Presiding Officer available chairs the Policy Committee and is the Vice-President of the current Conference.

3. The Presiding Officer, the Secretary/Treasurer, and the Program Officer are elected by a majority vote of those members attending a regularly scheduled business meeting of the Conference or by a majority vote of those replying to a mail ballot of the membership.

4. The Presiding Officer shall preside at all meetings of the Conference and shall arrange for a banquet speaker. On the first day of a Conference the Presiding Officer shall appoint the following committees, which shall serve until they have reported on the last day of the annual Conference:

(a) Nominating Committee,

(b) Committee to Recommend Future Meeting Places,

(c) Committee to Suggest Program Possibilities for Future Meetings,

(d) Resolutions Committee,

(e) Judging Committee,

(f) Audit Committee,

(g) such other *ad hoc* committees as may be required.

The Presiding Officer shall appoint the Conference Representative to the Council of the American Society of Parasitologists for the year, who must be a member of that society. The current Presiding Officer serves as a member without vote of the Policy Committee.

5. The Secretary/Treasurer shall issue annual dues notices and about four months prior to each Conference a call for participants in the program for each Conference; inform the new Presiding and Program Officers concerning their duties and the members of the Policy Committee of their tenure and the Secretary of the American Society of Parasitology within three weeks after the annual election; serve as member without vote and the Secretary of the Policy Committee: and supervise all funds of the Conference.

6. The Program Officer shall be responsible for the general format of the Conference and for arranging suitable facilities and funding. It shall also be this person's responsibility to chair the special committee to determine and collect the registration fee for the Conference. The format of the Conference may vary, but should include both a demonstration session and a session of contributed papers, both open to all members. A symposium may also be included or may replace a session of contributed papers.

7. The Policy Committee shall determine by majority vote all matters of procedure and policy pertaining to the Conference upon which decision must be reached between consecutive Conferences, as well as all matters referred specifically to it by the membership. Such a vote may be requested by any member of the Conference but must be directed through the Secretary/Treasurer. The Chairperson of the Policy Committee shall request approval by the membership for all decisions of the Committee at the earliest subsequent business meeting of the Conference.

8. The Conference confers three major awards during its annual meeting to student participants. These are the Chester A. Herrick Award, sponsored by the Eli Lilly Co., for the best poster/demonstration of parasitological research, the George A. LaRue Award for the best oral presentation of parasitological research, and the Raymond M. Cable Award for best presentation given by an undergraduate student. Honorable mention awards will be given to the second place poster/demonstration and second place oral presentation at the discretion of the awards committee. All awards except for the Herrick Award are supported by donations from the AMCOP membership.

9. (a) The winner of each award will be selected by a 3-person committee appointed at each annual meeting by the Presiding Officer. The criteria for judgment will be established each year by the committee.

(b) The size of the Herrick and LaRue awards shall traditionally be $300.00. The Cable undergraduate award and honorable mention awards shall traditionally be $100. Awards may vary according to funds available from contributors.

(c) No person may win the same award more than one time while in student status. Likewise, no student may win both awards at the same meeting. However, one person may win both awards while a student in different years.

SUMMARY OF AMCOP MEETINGS 1949-PRESENT

Year Meeting Site (Conference No.) Presiding Officer
Banquet Speaker & Title,
PO=Program Officer, ST=Secy/Treas,
H=Herrick Award, L=LaRue Award, HM=Honorable Mention, C=Cable Undergraduate Award;
S=Symposium Title and Speakers

1949 Univ. Wisconsin, Madison, WI (AMCOP I)........... Harley J. VanCleave
J.C. Baer,
ST=J. R. Lincicome

1950 Univ. Michigan, Ann Arbor, MI (II) .... R.V. Bangham
W.W. Cort, Trends in Helminthological Research.
PO/ST=R. J. Porter

1951 Purdue University, Lafayete, IN (III) .... L.O. Nolf
J.E. Ackert, Some Observations on Hookworm Disease.
ST=W. Balamuth

1952 Univ. Illinois, Urbana, IL (IV) .... R.J. Porter
A.C. Walton,
ST=W. Balamuth

1953 Iowa State College, Ames IA (V) .... C.A. Herrick
R.M. Cable, Parasitological Experiences in Puerto Rico.
ST=W.D. Lindquist

1954 Michigan State Univ., East Lansing, MI (VI) .... A.C. Walton
G.F Otto, Mosquitos, Worms, Somoans and the Parasitologist in Somoa.
ST=W.D. Lindquist

1955 Notre Dame Univ., IN (VII) .... R.M. Cable
G.R. LaRue, Relationships in the Development of Digenetic Trematodes.
ST=W.D. Lindquist

1956 Iowa State University, Ames, IA (VIII) .... W.D. Lindquist
W.H. Headlee,
ST=F.J. Krudenier

1957 Univ. of Michigan, Ann Arbor, MI (IX) .... J.E. Ackert
A.C. Chandler,

ST=F.J. Krudenier

1958 Kansas St. Univ., Manhattan, KS (X) .... G.R. LaRue
H.W. Manter, Trematodes of Many Waters.
ST=F.J. Krudenier

1959 Northwestern Univ., Evanston, IL (XI) .... G.F. Otto
H. Van der Schalie, Contrasting Problems in Conrol of Schistosomiasis in Egypt and the Sudan.
ST=D.T. Clark

1960 Purdue Univ., Lafayette, IN (XII) .... F.J. Krudenier
P.P. Weinstein, Aspects of Growth and Differentiation of Parasitic Helminths *in vitro* and *in vivo*.
ST=D.T. Clark

1961 Ohio State Univ., Columbus, OH (XIII) .... N.D. Levine
B. Schwartz, Parasitology Old and New.
ST=D.T. Clark

1962 Univ. of Nebraska, Lincoln, NE (XIV) G.W. Kelley, Jr
O.W. Olsen, The Life History of the Hookworm of Fur Seals.
ST=D.T. Clark

1963 Univ. of Minnesota, St. Paul, MN (XV) M.F. Hansen
F.G. Wallace, Observations on the Louisiana State University Inter-American Program in Tropical Medicine
ST=D.T. Clark

1964 Univ. of Chicago, Chicago, IL (XVI) D.T. Clark
R.E. Kuntz, Paragonimiasis in Formosa.
ST=E. J. Hugghins

1965 Kellogg Biological Station, Gull Lake, MI (XVII) P.E. Thompson
L. Jacobs, Toxoplasmosis.
ST=E.J. Hugghins

1966 Univ. of Illinois, Urbana, IL (XVIII) M.J. Ulmer
D.L. De Guisti, The Acanthocephala.
ST=E.J. Hugghins

1967 Iowa State Univ., Ames, IA (XVIV) P.J. Silverman
N.D. Levine, Parasitology, Problems and Promise.
ST=E.J. Hugghins
H=P.M. Nollen [FIRST HERRICK AWARD]

1968 Univ. of Wisconsin, Madison, WI (XX) F.G. Wallace
D.R. Lincicome, The Goodness of Parasitism. (with APS & AIBS)
ST=J.H. Greve,
H=W.G. Barnes

1969 Univ. of Cincinnati, Cincinnati, OH (XXI) H.W. Manter
H.W. Stunkard, Life Histories and Systematics of Parasitic Flatworms.
ST=J.H. Greve,
H=B. Caverny, H=T.P. Bonner

1970 Loyola Univ., Chicago, IL (XXII) J.L. Crites
M.J. Ulmer, Helminths from Midwest to Mediterranean.
ST=J.H. Greve,
H=H. Blankespoor

1971 Univ. of Louisville, Louisville, KY (XXIII) F. Etges
H. Van der Schalie, Dam Large Rivers-Then What?
ST=J.H. Greve,
H=R. Campbell

1972 Southern Illinois Univ., Carbondale, IL (XXIV) B.J. Jaskowski
R.M. Cable, The Lighter Side of Parasitology.
PO=T.T. Dunagan, ST=J.H. Greve
H=E.M. Cornford

1973 Notre Dame Univ., Notre Dame, IN (XXV) R. Shumard
R.F. Rick, Babesiosis and the Development of *Babesia* in Ticks.
PO=R. Thorson, ST=J.H. Greve,
H=D. Danley

1974 Univ. of Michigan, Ann Arbor, MI (XXVI) D. Ameel
M.J. Ulmer, Snails, Swamps and Swimmer's Itch.
ST=J.H. Greve,
H=P.T. LaVerde and D. Prechel

1975 Iowa State Univ., Ames, IA (XXVII) W. Bemrick
P.M. Nollen, Studies on the Reproductive Systems of Parasitic Flatworms or All You Wanted to Know About Sex in Worms and Were Afraid to Ask.
ST=J.H. Greve,
H=D. Wittrock, L=V.M. Nelson [FIRST LARUE AWARD]

1976 Univ. of Nebraska, Lincoln, NE (XXVIII) J. Greve
A.C. Todd, A Redefinition of Subclinical Parasitism and its Impact on World Politics.
ST=W.H. Coil, PO=M.H. Pritchard,
H=W.L. Current,L=C.A. Klu

1977 Kansas State Univ., Manhattan, KA (XXIX) T.T. Dunagan
A.J. MacInnis, Snails, Dollars, DNA and Worms.
PO=W.D. Lindquist, ST=W.H. Coil,
H=M. Fletcher, L=L. Smurro, L=J. Ketchum

1978 Indiana Central Univ., Indianapolis, IN (XXX) E.J. Hugghins
J.P. Dubey, Recent Advances in Feline and Canine Coccidia and Related Organisms.
PO=M. Brandt, ST=W.H. Coil,
H=D. McNair, L=G.L. Hendrickson

1979 Loyola Univ., Chicago, IL (XXXI) D.E. Gilbertson
E. Foor, Basic Studies in Reproduction (in Nematodes).
PO=B.J. Jaskowski, ST=W.H. Coil,
H=G. Plorin, H=D. Minchella, L=M. Fletcher

1980 Eastern Michigan Univ., Ypsilanti, MI (XXXII) A.D. Johnson
J.R. Williams, Tropical Parasitiology at the Junction of the White and Blue Nile Rivers.
PO=E. Waffle, ST=G. Garoian,
H=C.L. Williams, L=M. Goldman, L=R. Gamble,
S=Functional Morphology of Acanthocephala

1981 Eastern Illinois Univ., Charleston, IL (XXXIII) D.M. Miller
G.D. Cain, Antigenic Variation: New Techniques Applied to Old Problems.

PO=B.T. Ridgeway, ST=G. Garoian,
H=J.M. Holy, L=B.N. Tuggle,
S=Immunity to Protozoan Parasites

1982 Western Illinois Univ., Macomb, IL (XXXIV) D.G. Myer
J.D. Briggs, Biological Control of Invertebrates in International Programs.
PO=P.M. Nollen, ST=G. Garoian,
H=D.E. Snyder, L=C.L. Williams,
S=Biological Control of Organisms

1983 Univ. of Illinois, Urbana, IL (XXXV) C.M. Vaughn
H.M. Moon, Speculations on the Pathogenesis of Cryptosporidiosis with Comparisons to Other Enteric Infections.
PO=K.S. Todd, Jr, ST=G. Garoian,
H=K.J. Hamann, L=K.W. Bafundo,
S=Intestinal Protozoa

1984 Univ. of Iowa, Iowa City, IA (XXXVI) W.H. Coil
J. Donelson, Genetic Rearrangement and the Basis of Antigenic Variation in African Trypanosomes.
PO=G.D. Cain, ST=G. Garoian,
H=K.F. Forton, L=D. Woodmansee,
S=Helminth Immunology

1985 Ohio State Univ., Columbus, OH (XXXVII) B.T. Ridgeway
K.D. Murrell, Epidemiology of Swine Trichinosis: Could Both Zenker and Leuckart be Right?,
PO=P.W. Pappas, ST=G. Garoian,
H=R.L. Lavy, L=H.K. Forton,
S=Physiological Ecology of Parasites

1986 Univ. of Missouri, Columbia, MO (XXXVIII) .... G.D. Cain
R.C. Tinsley, Correlation of Host Biology in Polystomatid Monogenea.
PO=L. Uhazy, ST=D.M. Miller
H=M.C. Lewis, H=I.G. Welsford, L=D.A. Leiby, ,
S=Gene Expression in Helminth Development

1987 Southern Illinois Univ., Edwardsville, IL (XXXIX) P.M. Nollen
K. Kazacos, *Baylisascaris* Nematodes-Their Biology and Role in Larva Migrans Disease.
PO=D. Myer, ST=D.M. Miller,
H=D.A. Leiby, L=V.A. Conners,
S=Modern Systematics in Parasitology

1988 Purdue University, West Lafayette, IN (XL) .... G. Garoian
W.H. Coil, Forty Years of AMCOP, Laying a Foundation.
PO=K. Kazacos & D. Minchella, ST=D.M. Miller,
H=R.A. Bautz, L=R.R. Mitchler,
S=Host Parasite Genetics

1989 Miami Univ., Oxford, OH (XLI) .... A.E. Duwe
G. Castro, A Physiological View of Host-parasite Interactions.
PO=R.A. Grassmick, ST=D.M. Miller,
H=S.R. Morris, S=Parasites in the Immune Suppressed

1990 Univ. Illinois, Urbana, IL (XLII) .... J. H. Hubschman
G. Cross, Phosphatidylinositol Membrane Anchor and/or Transfection of Protozoa.
PO=G. McLaughlin, ST=D.M. Miller,
H=L.D. Morton, L=S.R. Morris,
S=Defining the Limits of Integrated Pest and Disease Management.

1991 University of South Dakota, Vermillion, SD, (XLIII) K. R. Kazacos
M. Dryden, What You Always Wanted to Know About Fleas on Fluffy and Fido but were Afraid to Ask.
PO=A. D. Johnson, ST=D.M Miller,
H=D. Royal, L=R. Clopton,
S= Host Specificity

1992 Univ. Wisconsin-Eau Claire, WI, (XLIV) .... Omer Larson
PO=D. Wittrock, ST=D.M.Miller,
H=S. Storandt, L=D. K. Howe,
S=Teaching of Parasitology-New Methods

1993 St. Mary's, Notre Dame, IN, (XLV) .... R. A. Grassmick
J. Crites, AMCOP Peragrare Anni, Homines, Exitus
PO=T.R Platt, ST=D.M.Miller,
H=M. S. Schoen, L=B. J. Davids,
S="Ain't Misbehavin'": Ethology, Phylogeny and Parasitology

1994 Murray State Univ. Murray, KY (XLVI) .... Gary Uglem
E. Christiansen, Come out, come out, we know you are in there.
PO=L. Duobinis-Gray, ST=D. J. Minchella,
H=J. Rosinski,L=R. Garrison, S=Parasite Ecology: Population and Community Dynamics

1995 Univ. of Wisconsin-Milwaukee (XLVII) .... Darwin Wittrock
E.S. Loker, Schistosomiasis in Kenya: a Copernican point of view
PO= J. Coggins, ST=D.J. Minchella;
H=J. Curtis; L=M. Dwinnell
S=Water-borne Diseases

1996 Northeast MO State Univ., Kirksville, MO (XLVIII) Daniel Snyder
PO=L. C. Twining, ST=D.J. Minchella,
H= V. G. Mehta, L=H. Yoder,
S=Immune Aspects of Protozoan Infections: Malaria and Amoebiasis

1997 Butler University, Indianapolis, IN, (XLIX) .... Joe Camp
R. Hengst, Paleoparasitology,
PO=D. Daniell; ST=D.J. Minchella;
H=A. Bierberich, L=S. Kappe, S=Molecular Biology in Solving Problems in Parasitology

1998 Indiana State University, Terre Haute, IN (L).......... Jim Coggins
W. Coil, J. Crites, & T. Dunagan, AMCOP 50 - Fifty Years Revisited;
PO=F. Monroy & D. Dusanic; ST=D. Wittrock;
H=M. Bolek; L=K. Page
S= Cytokines and Parasitic Diseases; Visit by ASP President John Oaks

1999 Wilmington College, Wilmington OH (LI) .... Dennis Minchella
P. LoVerde, Molecular Biology of Schistosomes,

PO= D. Woodmansee,ST=D. Wittrock;
H= J.B.Green; L=J. Curtis;
S=Parasite Biochemistry by J.D. Bangs and C.F. Fioravanti.

2000 University of Notre Dame, Notre Dame, IN (LII).... Peter Pappas
J.A. Oaks – Zen and the Art of Tapeworms
PO= J. H. Adams; ST= D. Wittrock;
H= A. Eppert; L= M. Bolek; HM= C. Dresden-Osborne & K. VanBuskirk
S=Life Style Choices of Parasitic Protozoans by T. Sinai and J. Lebowitz

2001 Eastern Illinois University, Charleston, IL (LIII)..... Lin Twining
R.D. Smith - Environmental contamination with *Cryptosporidium parvum* from a dairy herd.
PO= J. Laursen; ST= D. Wittrock;
H= B. Foulk; L= M. Michalski ; HM= M. Gillilland III; B. Balu and P. Blair
S= Use of Molecular Data in Parasite Systematics by M. Mort and M. Siddall

2002 Millikin University, Decatur, IL (LIV) .... David Williams
P. Brindley – Mobile genetic elements in the schistosome genome
PO=Tom McQuistion; ST= D. Wittrock;
H= Stacy Pfluger; L= Greg Sandland;
HM= Kelly VanBuskirk and Michelle Steinauer
S= Parasite Transmission and Control in Domesticated Animals by M. McAllister and L. McDougald

2003 Michigan State University, East Lansing (LV) .... Tom Platt
Robert Pennock – Darwin and the Parasitic Wasp: Teaching Evolutionary Design;
PO= Pat Muzzall; ST= Darwin Wittrock;
H= Luis Gondim; L= Michelle Steinauer; HM= Shawna Cook and Ahmed Sayed; C= Katie Reif; S= Vector Borne Diseases of Michigan and Adjacent States by Ned Walker and Hans Klompen

2004 Minnesota State University, Mankato, MN (LVI) .. Patrick Muzzall
Richard Clopton – Publishing with pain: The editor doesn't really hate you.
PO= Robert Sorensen, ST= Darwin Wittrock
H=Rebecca LaBorde; L= Maria Castillo;
HM= Angie Kuntz and Laura Duclos; C=Jenna Rodgers
S= Molecular phylogenetics of parasites by Vasyl Tkach and Ramon Carreno

2005 Wabash College, Crawfordsville, IN (LVII).... Douglas Woodmansee
John Adams - In a changing world of malaria research, can an old dog learn new tricks?
PO= Eric Wetzel, ST= Darwin Wittrock
H= Amy McHenry; L= Laura Duclos;
HM= Jillian Detwiler and Julie Clennon; C= Kristin Giglietti;
S= Molecular Phylogenies in Nematoda by Virginia Ferris and Microbial Community Ecology of Tick-borne Human Pathogens by Keith Clay

2006 Winona State University, Winona, MN (LVIII) ...... Thomas McQuistion
Matthew Bolek - Amphibian parasites: The cool, the bad and the ugly.
PO= Kim Bates; ST= Doug Woodmansee;
H= Andrew Claxton; L= Kristin Herrmann; C= Lindsey Stillson;

HM= Brenda Pracheil, Kristin Giglietti;
S= Parasites of Wildlife of the Midwest by Rebecca Cole and Darwin Wittrock

2007 University of Wisconsin-Oshkosh, Oshkosh, WI (LIX) Jason Curtis
David Williams – The Genomics Revolution in Parasitology.
PO= Shelly Michalski, ST= Doug Woodmansee;
H= Christine Hsiao; L= Shriveny Dangoudoubiyam
HM= Peter Ziniel, Nathan Peterson; C= Emily Doucette,
S= Tropical Disease by Gary Weil and Peter Fischer

2008 University of Illinois at Urbana-Champaign (LX) ... Robert Sorensen
Dennis Minchella – P.C. (Post Cable) Parasitology at Purdue.
PO= Milton McAllister, ST= Doug Woodmansee;
H= Nathan Peterson; L= Erica Mize
HM= Apichat Vitta, Jillian Detweiler; C= Kyle Luth,
S= Parasitic Protists by Laura Knoll and Alexa Rosypal.

2009 Ohio Wesleyan University, Delaware, OH (LXI) Daniel Howe
Eugene Lyons - Hookworms (*Unicaria* spp.) in Pinnipeds with Notes on the Biology of Northern Fur Seals.
PO= Ramon Carreno, ST= Doug Woodmansee;
H= Sriveny Dangoudoubiyam; L= Elizabeth Thiele, HM= Matthew Brewer; C= Cailee Smith;
S= Ectoparasites by Susan C. Jones and Glen R. Needam

2010 Western Illinois University, Macomb, IL (LXII) Jeffrey Laursen
Tim Yoshino - Frankenflukes: Parasitic GMO's.
PO= Shawm Meagher, ST=Doug Woodmansee;
H=Kathryn Coyne; L=Philip Scheibel; HM= Kathy Johnson; C= Bryan Rolfsen;
S= Can Parasitic worms treat autoimmune disorders? by David Elliott and John O. Fleming.

2011 Saint Mary's College, Notre Dame IN (LXIII)........ Shelly Michalski
Bruce Christensen – Programmes for control of lymphatic filariasis: perspectives from a vector biologist.
PO= Tom Platt, ST= Doug Woodmansee;
H=Daniela Cortese; L=Ablesh Gautam HM= Jenica Abrudan, Elizabeth Warburton; C= Markah Frost, Sarah Johnson; S=Parasitonomics by Mary Ann McDowell and Mike Ferdig.

2012 Truman State University, Kirksville, MO (LXIV).. Shawn Meagher
Scott D. Snyder - Parasite Biodiversity: Reflections, Challenges and Opportunities.
PO=Lin Twining , ST= Doug Woodmansee
H= Utibe Bickham; L= Heather Stigge; C= Michael Lehrke; HM= Shelby Heistand;
S= The importance of the unimportant. & Understanding the histories of parasites of Galapagos birds.
by John Janovy and Patricia Parker.

2013 Purdue University, West Lafayette, IN (LXV) .... Kimberly Bates

Agustin Jimenez - Biodiversity in the New World: "What is it?", still a relevant question.
PO=Joe Camp , ST= Doug Woodmansee
H= Heather Stigge; L= Elizabeth Warburton HM= Ablesh Gautam and Bhagya Wijayawardena; C= David Cordie;
S=DNA Barcoding in Parasitology Research by Sean Locke and Mark Forbes

2014 The University of Kentucky .... Agustin Jimenez
PO=Daniel Howe, ST= Robert Sorensen
H= Alyssa Gleischner; L= Miranda White; HM= Leah Peng and Elizabeth Warburton; C= Allison Young;
S= Parasite adaptation and anthelmintic resistance by Martin K. Nielsen and Craig R. Reinemeyer

2015 Lawrence University .... Trudy Aebig
PO=Judith Humphries, ST= Robert Sorensen
H= Justin Wilcox; L= Elliot Zieman HM= Heather Toman, Evan Boone; C= Erik Rodriguez and John Lopez;
S= Wildlife Disease by Dr. Rebecca Cole and Dr. Shelly Dubay

2016 Lawrence University .... Matt Brewer
PO=Agustín Jimenez, ST= Robert Sorensen
H=?; L=? HM= ?; C=?;
S= Physiology of mosquitoes in the anti-pathogen response AND interactions among geohelminths and the human gut micorbiome by Dr. Julián Hillyer Vanderbilt University and Dr. Makedonka Mitreva Washington University in St. Louis

FINANCIAL REPORTS

2015 AMCOP Financial Report
Jan. 1, 2015-Dec. 31, 2015
Updated 6/07/2016

Balance Available 1/1/2015		**$7,268.98**
Expenses		
AMCOP 67 Program Duplication	$115.97	
Postage	$0.00	
Certificates & Holders	$38.23	
Herrick Award	$300.00	
LaRue Award	$300.00	
Cable Award	$200.00	
Honorable Mention Awards	$200.00	
Verification of Good Standing- MN	$0.00	
Web Site Expense (Go Daddy)	$0.00	
Event Insurance	$278.00	
Bank Fees	$0.00	
Office Supplies	$19.80	
Speaker Expenses-Symposium	$233.79	
2013 Student Travel Awards	$0.00	
2014 Student Travel Awards	$250.00	
Research Grants Program	$500.00	
Total Expenses		**$2,435.79**
Income		
2015 Dues Payments	$415.00	
2015 Member Contributions	$495.00	
Lilly Donation	$0.00	
ASP Support	$250.00	
Silent Auction Revenue	$211.00	
Interest Income (through 12/31/15)	$6.22	
AMCOP 66 Surplus (Loss)	$137.50	
Total Income		**$1,514.72**
Operating Surplus (Loss) for 2015		**($921.07)**
Net Worth (12/31/15)		**$6,347.91**

Submitted By:

Robert E. Sorensen

Robert E. Sorensen
Secretary / Treasurer

Financial Report Approved by

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2016 AMCOP Interim Financial Report
Jan. 1, 2015-Dec. 31, 2015
Updated 6/08/2016

Balance Available 1/1/2016		**$6,437.91**
Expenses		
AMCOP 67 Program Duplication	$0.00	
Certificates & Holders	$0.00	
Herrick Award (budgeted)	$300.00	
LaRue Award (budgeted)	$300.00	
Cable Award (budgeted)	$200.00	
Honorable Mention Awards (budgeted)	$200.00	
Web Site Expense (Go Daddy)	$29.74	
Site Food (budgeted)	$2,389.10	
Site Fees (budgeted)	$1,191.00	
Lunch & Banquet	$1,547.00	
Office Supplies	$0.00	
Speaker Expenses-Symposium	$0.00	
2015 Student Travel Awards	$200.00	
2016 Student Travel Awards(budgeted)	$250.00	
Research Grants Program (budgeted)	$1,000.00	
Total Expenses		**$7,606.84**
Income		
2016 Dues Payments	$375.00	
2016 Member Contributions	$708.00	
Member Catering Charges	$1,547.00	
Member Registration Fees	$945.00	
Lilly Donation	$900.00	
ASP Support		
PLoS Donation	$400.00	
Silent Auction Revenue		
Interest Income (through 6/01/16)	$2.97	
AMCOP 68 Surplus (Loss)		
Discrepancy relative to deposit	$32.00	
Total Income		**$4,909.97**
Operating Surplus (Loss) for 2016		**-$2,696.87**
Net Worth (6/08/16)		**$3,741.04**

Submitted By:

Robert E. Sorensen

Robert E. Sorensen
Secretary / Treasurer

Financial Report Approved by

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Membership Email Directory (Dues paid in either 2015 or 2016)

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