SOUTHWESTERN ASSOCIATION OF PARASITOLOGISTS

45th Annual Meeting
Program & Abstracts

April 12–14, 2012

The University of Oklahoma Biological Station
Lake Texoma, Oklahoma

Affiliate, American Society of Parasitologists

SOUTHWESTERN ASSOCIATION OF PARASITOLOGISTS

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AGENDA

Thursday, April 12, 2012

5:00-9:00 pm	Registration	Foyer of Dining Hall
6:30 pm	Dinner	Dining Hall
7:15 pm	Presenters' Meeting	Library
8:30 pm	Social Hour(s)	Dining Hall

Friday, April 13, 2012

7:30–8:30 am	Breakfast & Registration	Dining Hall
8:35–8:45am	Opening Remarks	Library
8:45–10:15 am	1. Oral Presentations (#1–6)	Library
10:15–10:30 am	Break	
10:30–11:45 am	2. Oral Presentations (#7–11)	Library
Noon–1:00 pm	Lunch	Dining Hall
1:00–2:45 pm	3. Oral Presentations (#12–18)	Library
2:45–3:00 pm	Break	
3:00–5:00 pm	4. Oral Presentations (#19–26)	Library
5:00–6:00 pm	President's Reception	Pavilion on the Lawn AND
	AND	
	5. Poster Session (#27–32)	Dining Hall
6:00–7:00 pm	Dinner	Dining Hall
7:00–8:30 pm	SWAP Business Meeting	Library
9:00 pm	Social Hour(s)	Dining Hall

Saturday, April 14, 2012

7:30–8:30 am	Breakfast	Dining Hall
9:00–9:45 am	6. Oral Presentations (#33–36)	Library
10:00 am	Adjournment	

ABSTRACTS WITH A "UG" ARE UNDERGRADUATE STUDENT PAPERS IN THE COMPETITION; THOSE WITH A "G" ARE GRADUATE STUDENT PAPERS IN THE COMPETITION. ALL FRIDAY PAPERS ARE IN THE COMPETITION AND UNLESS NOTED, SPEAKER IS FIRST AUTHOR LISTED.

Friday, April 13, 2012—Morning Session—Oral Presentations
LIBRARY
8:35–8:45 am
Opening Remarks – President ALAN M. FEDYNICH

1. Oral Presentations (#1–6)
Chairperson/Projectionists
Seph Fauver, Peru State College, Peru, Nebraska
Jon Kohlman, Peru State College, Peru, Nebraska

8:45 am

G 1. Understanding Evolutionary Changes in Parasite Life Cycle Complexity Using the Genus *Alloglossidium* as a Model.
Emily L. Kasl[1], William F. Font[2], and Charles D. Criscione[1]. [1]Department of Biology, Texas A&M University; [2]Biology Department, Southeastern Louisiana University.

Life cycle complexity (number and host species needed to complete development) can influence parasite transmission, gene flow, and mating systems, and thus, is a key determinant of parasite ecology and evolution. Before comparative approaches can be used to understand how different life cycle patterns impact parasite ecology and evolution, it is first necessary to elucidate the phylogenetic patterns of changes in life cycle complexity. Many digeneans have a 3-host life cycle, where worm sexual reproduction occurs in a vertebrate final host, but some species exhibit a 2-host pattern where sexual maturity occurs in what is typically considered the second intermediate host. In the genus *Alloglossidium*, 2- and 3-host life cycles are present and a variety of final hosts are used (catfish, crustacean, or leech). Thus, this genus provides a model system to study the evolution of life cycle complexity. Previous studies on this genus have led to 3 hypotheses about the origin of changes in life cycle pattern: 1) an ancestral 3-host life cycle underwent 2 independent losses of the vertebrate host, 2) the 3-host pattern was derived from an ancestral 2-host (leech final host) life cycle, and 3) a single transition led from a 3-host to a 2-host pattern, with subsequent host switching from crustaceans to leech final hosts. These hypotheses were based on deductive reasoning (1, 2) or a phylogeny generated from morphological and life history data (3). Here we use mtDNA and nuclear DNA data to conduct an independent test of the evolutionary changes in life cycle complexity. Using representative *Alloglossidium* species with different life cycles we present a reconstruction of relationships within the genus and assess support for the 3 previous hypotheses. In particular, our data suggest multiple origins of changes in life cycle complexity. We discuss the broader context of these results in terms of Dollo's law of irreversibility, developmental changes, host use, and the potential to do subsequent comparative ecological/evolutionary studies using the genus *Alloglossidium*.

9:00 am

G 2. Parasitic Infections in Northern Bobwhites Across an Annual Breeding Cycle. Stacie M. Villarreal, Alan M. Fedynich, Leonard A. Brennan, and Dale Rollins[1]. Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX, 78363; [1]Texas AgriLIFE Research, Texas A&M University, San Angelo, TX, 76901.

The northern bobwhite (*Colinus virginianus*) in Texas has been steadily declining over the past several decades, generating growing concerns about possible causes in addition to habitat loss. Assessments of parasites infecting bobwhites in Texas have not been conducted since the 1980s**.** Most of these studies have used bobwhites collected during the hunting season (November–February) and, as such, have sampled only "survivors" of the summer breeding season. The objective of this study was to assess the prevalence and abundance of helminths in bobwhites from the Rolling Plains Ecoregion of Texas during an annual cycle and determine whether infections are related to season (spring 2010, summer 2010, winter 2010–2011), host age (juvenile, adult), and host sex (male, female). Forty-five adult males, 23 adult females, 37 juvenile males, and 37 juvenile females were collected from two ranches in Fisher County during spring 2010 (n=37), summer 2010 (n=51), and winter 2010–2011 (n=54) and examined for helminths. The cecal nematode *Aulonocephalus pennula* was most common (82%), followed by the eyeworm *Oxyspirura petrowi* (47%), *Tetrameres pattersoni* (26%), cystacanths (18%), cestodes (*Rhabdometra odiosa* and *Raillietina* spp., 9%), and *Dispharynx nasuta* (0.7%). Ranked abundance values for *A. pennula*, *O. petrowi*, and *T. pattersoni* were higher in adults than juveniles and lower in summer-collected hosts than those collected in winter or spring. Findings from this study provide a better understanding about helminth infections within bobwhites in relation to this host's annual cycle. The implications of high prevalence of cecal worms and eyeworms in this bobwhite population and their potential to exacerbate animal predation on bobwhites warrant further investigation.

9:15 am

UG 3. Helminths of *Micaelayms namaquensis* and *Aethomys chrysophilus* (Rodentia: Muridae) from Northwestern Botswana. Linden Reid, Tamara J. Cook, and Monte L. Thies**.** Department of Biological Sciences, Sam Houston State University Huntsville, TX.

Two species of Botswanan rodents, *Micaelamys namaquensis* (Namaqua rock rat) and *Aethomys chrysophilus* (veld rat), were collected from the Koanaka Hills region of Ngamiland Province in northwestern Botswana in June 2008 and July 2009. The gastrointestinal tracts of 40 specimens (20 *M. namaquensis* and 20 *A. chrysophilus*) collected from 3 of 6 microhabitats identified as part of a biotic inventory project investigating the effects of wildfire were examined for helminths. Prevalence and intensity were calculated to potentially reveal correlations between parasite prevalence and host sex, habitat range, and environmental factors. Gastrointestinal tracts were removed in the field, preserved in 95% ethanol, and returned to SHSU for subsequent analyses. Helminths were removed and stored in 70% ethanol for preservation. Cestodes were stained with hematoxylin and eosin and nematodes were viewed under wet mounts of glycerin and ethanol. Helminths were examined with an Olympus BX51 microscope and digital images of all specimens were captured with an Olympus DP 72 digital camera. Nematodes had the highest prevalence of infection in *A. chrysophilus* at 70%, with a lower prevalence in *M. namaquensis* at 65%. Prevalence of cestodes in *A. chrysophilus* was 10%, while the prevalence of cestode infection in *M. namaquensis* was 5%.

9:30 am

G 4. New Records of *Acanthobothrium* from the Cortez Electric Ray, *Narcine entemedor*, Off the Pacific coast of Costa Rica. N. H. Odell and K. Jensen. Department of Ecology and Evolutionary Biology and Biodiversity Institute, University of Kansas.

Few records of species of the tapeworm genus *Acanthobothrium* parasitizing elasmobranchs off the Pacific coast of Costa Rica exist. Only 9 species of *Acanthobothrium* have been reported from the approximately 68 species of elasmobranchs known to occur in this region. One of these records comes from the Cortez electric ray, *Narcine entemedor*, with a distribution including the Gulf of California south to Peru; 2 species of *Acanthobothrium*, *A. franus* and *A. inbiorium* have previously been described from this host from Costa Rica. During a survey of tapeworms of elasmobranchs caught by the deepwater shrimp fisheries of Pacific Costa Rica, 5 specimens of *N. entemedor* were collected and examined for parasites. Spiral intestines were removed in the field, fixed in 4% formalin buffered seawater, and stored in 70% ethanol. Tapeworms encountered during examination of spiral intestines in the lab were removed and prepared for light and scanning electron microscopy using standard techniques. At least 4 species of *Acanthobothrium* were found to parasitize the Cortez electric ray, of which 2 were of a larger type (>1.5 cm) and 2 were of a smaller type (<1.0 cm). While specimens of the 2 large species were identified as resembling *A. franus* and *A. inbiorium*, several inconsistencies with the features reported in the original description were observed (e.g., proglottid overlap, and presence or absence of gravid proglottids). Microthrix patterns are presented for both of these species for the first time. The 2 smaller *Acanthobothrium* species appear to be new to science, and can be distinguished from one another based on scolex size and testes number. Whether specimens of *N. entemedor* from the Gulf of California are host to the same *Acanthobothrium* species as those observed from Costa Rica will be part of a future investigation.

9:45 am

G 5. Spermatozoon Ultrastructure of *Adelobothrium* Shipley, 1900 (Eucestoda: Lecanicephalidea). J. J. Cielocha, A. Yoneva[1], and K. Jensen. Department of Ecology and Evolutionary Biology & Biodiversity Institute, University of Kansas; [1]Institute of Biodiversity and Ecosystem Research, Bulgaria.

Spermatozoon ultrastructural characters have shown to be informative in phylogenetic studies among cestode orders. Detailed comparative data exist on the sperm ultrastructure of most cestode orders, though information for the Lecanicephalidea is very limited. The only previous data on lecanicephalidean sperm ultrastructure came from a specimen of the genus *Tetragonocephalum* from *Himantura* sp. (Justine, 2001). Mature spermatozoa of *Tetragonocephalum* were described as possessing a crested body, parallel cortical microtubules, and a single axoneme. Based on these data, Levron et al. (2010) suggested lecanicephalideans to have Type IV spermatozoa and postulated a spiral nucleus. One specimen each, of 2 species of *Adelobothrium* were collected from eagle rays (*Aetobatus* spp.) in Vietnam and fixed for transmission electron microscopy (TEM). The posterior-most proglottids with well-developed external seminal vesicles were cut from the strobila of each individual and processed for TEM: proglottids were embedded in Spurr's resin; ultrathin sections were cut on an ultramicrotome, mounted on copper grids, double stained with uranyl acetate and lead citrate, and observed with TEM. Sperm ultrastructure was identical for both species of *Adelobothrium* and generally consistent with previous observations of *Tetragonocephalum.* For the first time the state of the nucleus, parallel or spiraled around the axoneme, is presented. *Adelobothrium* is only the second genus of lecanicephalidean for which sperm ultrastructure has been determined. Given that variation within orders has been documented for other cestode groups studies focusing on additional lecanicephalidean taxa will provide a more comprehensive perspective on sperm ultrastructure in this order. Moreover, details of spermiogenesis remain to be documented for lecanicephalideans.

10:00 am

UG 6. Excystation Signals Do Not Isolate Gregarine Gene Pools: Experimental Excystation of *Blabericola migrator* Among Eleven Species of Cockroaches. Shelby M. Steele, Debra T. Clopton, and Richard E. Clopton. Department of Natural Science, Peru State College, Peru, Nebraska, 68421, U.S.A.

An experimental excystation assay was used to test the potential species isolating effect of host excystation signaling among gregarines. Oocysts of a single gregarine species, *Blabericola migrator*, were tested for activation, excystation, and sporozoite motility using intestinal extracts from 11 species of cockroaches representing a cohesive phylogeny of seven genera, three subfamilies, and two families of Blattodea. Sporozoite activation, excystation, and motility were observed for all excystation assay replications using intestinal fluid from hosts in the family Blaberidae, but delayed activation or excystation was observed for all excystation assay replications using intestinal fluid from hosts in the family Blattidae. The study results illustrate a trend toward a generalized host excystation signal among gregarines that is conserved across the host clade at a subfamily or family level, but is unlikely to play a significant role as a species isolating mechanism among gregarine sibling species.

10:15–10:30 am — BREAK

LIBRARY

2. Oral Presentations (#7–11)
Chairperson/Projectionists
David Shaffer, Peru State College, Peru, Nebraska
Mallory Mardock, Sam Houston State University Huntsville, Texas

10:30 am

UG 7. Delineating Morphological Species Boundaries in Gregarines of the Genus *Protomagalhaensia*: A Foundation for New Character Search. Joseph R. Fauver, Debra T. Clopton, and Richard E. Clopton. Department of Natural Science, Peru State College, Peru, Nebraska, 68421, U.S.A.

Gregarine species are traditionally delineated by differences in the development, morphology, and relative metric ratios of oocysts, epimerites, gamonts in association, and gametocysts. These techniques are used to delineate 5 species comprising the genus *Protomagalhaensia* as a model system to identify potential "cryptic species" within the group. Traditional morphometric techniques prove relatively robust given an approach that includes 1) a population centroid and variation approach, 2) adequate sample size, 3) partitioning developmental variation and sexual dimorphism, 4) recognition and minimization of fixation and physiological artifacts to eliminate false morphotypes, and 5) use of comparative data sets across multiple life cycle stages. The genus *Protomagalhaensia* provides a foundation system of sibling gregarine congeners to test the efficacy of new developmental, life cycle, morphological, and genetic character suites for delineating gregarine species.

10:45 am

<u>UG</u> 8. Anatomy of a Range Boundary II: Habitat Structure and *Paulisentis missouriensis* in Southeastern Nebraska. E. B. Olsen and M. A. Barger. Department of Natural Science, Peru State College, Peru, Nebraska, 68421, U.S.A.

Paulisentis missouriensis is an acanthocephalan parasite of creek chub, *Semotilus atromaculatus*, in southeastern Nebraska. Previous work has demonstrated that *P. missouriensis* occurs in two drainages of the Big Nemaha River watershed (South Fork and Turkey Creek) but is absent from two others (North Fork and Muddy Creek). This study tested the hypothesis that the presence/absence of *P. missouriensis* is associated with structure and availability of stream habitats; specifically, that streams lacking *P. missouriensis* lack the density and stability of pool habitats to support successful transmission and population growth of *P. missouriensis*. Habitat structure was measured by counting and measuring the depth of pools in 500 m segments of 12 streams randomly selected from first-order and second-order streams in each of the 4 drainages, and by mapping habitat structure in a subsample of those streams. Pool density was higher in those drainages lacking *P. missouriensis*, but the maximum depth of pools was greater in drainages where *P. missouriensis* occurs, although not in all streams. Mapping of streams indicated that pools in streams where *P. missouriensis* is present are larger, more stable, and that large, permanent pools are more regularly distributed than in streams where *P. missouriensis* is absent. The presence or absence of beaver ponds alters this pattern. These results suggest habitat differences among drainages that, consistent with current knowledge of the life cycle of *P. missouriensis*, could explain the abrupt range boundary observed in the Big Nemaha River system. However, some of the results are ambiguous or contradictory, and other hypotheses remain to be tested.

11:00 am

<u>UG</u> 9. A Survey of *Peromyscus leucopus* and *Peromyscus maniculatus* and the Ectoparasites that Commonly Parasitize Them in Southeast Nebraska. Scott Oldfield and John Hnida. Department of Natural Science, Peru State College, Peru, Nebraska, 68421, U.S.A.

Peromyscus leucopus and *P. maniculatus* are both commonly located in the southeastern corner of Nebraska. Ticks, fleas, mites, and bot flies are a few of the parasitic organisms that commonly affect their populations. The purpose of this study was to evaluate whether the populations of *P. maniculatus* and *P. leucopus* differed, to examine the prevalence of the different types of ectoparasites found on these mice, to determine if changes in weather and temperature affect the prevalence of these parasites, and finally to determine if certain species of ticks are species specific. *Peromyscus* species were captured using Sherman folding traps for 7 months (April-October 2011). The two species of hard ticks that were identified were *Amblyomma americanum* and *Dermacentor variabilis*. Both tick species were commonly found, but it is clear that *A. americanum* were more predominant in this area throughout the trapping season. The prevalence of the *A. americanum*, *D. variabilis*, fleas, and mites found on *Peromyscus* were, respectively, 36.8, 10.5, 26.3, and 28.9 percent.

11:15 am

G 10. Do Intermediate Hosts Play a Role in Parasite Population Structure? A Phylogeographic Study of *Trichobilharzia querquedulae.* E. T. Gendron, D. Malone, E. S. Loker, and S. V. Brant. Center for Evolutionary and Theoretical Immunology, Department of Biology, Division of Parasitology, Museum of Southwestern Biology, University of New Mexico.

Host influence on parasite distribution and population dynamics is not clearly understood, and is an understudied area within Parasitology, especially in heteroxenous systems. Yet, is a key component of understanding parasite evolutionary ecology. Determinants of gene flow, dispersal ability of larvae and degree of host specificity, remain largely unknown. How does the intermediate host, typically with more restricted dispersal abilities, contribute to gene flow within parasite populations when the definitive host is vagile? Avian schistosomes, which represent an amazing diversification within the blood fluke family Schistosomatidae, cycle through aquatic snail intermediate hosts, which have restricted dispersal abilities, and highly vagile water birds as their definitive hosts. Within Schistosomatidae, *Trichobilharzia* is the most speciose genus infecting primarily ducks and two families of snails worldwide. In an effort to understand how population structure relates to patterns and mechanisms of diversification, we reconstructed the phylogeography of *Trichobilharzia querquedulae*, using mitochondrial ND4 gene region and created a haplotype map of subpopulations across its known range. *Trichobilharzia querquedulae*, found throughout North America infects three species of dabbling ducks and uses physid snails as an intermediate host. Is there evidence of population structure in a species with a highly vagile avian host? We predicted that there would be high gene flow and a homogenization of genetic diversity, driven by the definitive host. We also predicted that the haplotype map would reveal hidden genetic diversity between infrapopulations, due to the dispersal of the intermediate host. Our phylogeographic analysis showed no population structure within *T. querquedulae* based on definitive or intermediate host, or geography. Haplotype maps provided a finer resolution of genetic diversity, which proved to be higher than expected. These findings aid in understanding the role that each host plays in parasite distribution and population dynamics of a widespread and diverse genus of schistosomes.

11:30 am

G 11. Ecological Niche Model Prediction of *Cytauxzoon felis* Distribution in Oklahoma, Missouri, and Arkansas. Elisha Mueller[1], Kristen A. Baum[1], Monica Papeş[1], Leah A. Cohn[2], and Mason V. Reichard[3]. [1]Department of Zoology, Oklahoma State University, Stillwater, OK, 74078, U.S.A.; [2]Veterinary Medical Teaching Hospital, University of Missouri, Columbia, MO, 65211, U.S.A.; [3]Department of Veterinary Pathobiology, Oklahoma State University, Stillwater, OK, 74078, U.S.A.

Infection of *Cytauxzoon felis* in domestic cats (*Felis catus*) is characterized by lethargy, fever, anorexia, icterus, anemia, and usually death. The definitive hosts for *C. felis* include *Amblyomma americanum* and *Dermacentor variabilis* whereas intermediate hosts are bobcats, *Lynx rufus*, and occasionally domestic cats that survive infection. Current knowledge of *C. felis* distribution is based on the observation and reports of clinical cases of cytauxzoonosis in cats. Despite the severity of cytauxzoonosis in domestic felids, the ecological distribution of *C. felis* based on preferred habitats of hosts has not been evaluated or defined. To determine the potential extent of the distribution of *C. felis* in Oklahoma, Missouri, and Arkansas, two separate ecological niche models were constructed. First, a model used occurrence data of confirmed cytauxzoonosis cases in domestic cats and several different WorldClim environmental layers. The second model incorporated occurrences of bobcats with environmental layers and land cover suitable for ticks where *C. felis* transmission is likely. Results of both models indicate a high probability of *C. felis* in central Oklahoma to south central Missouri. However, for the rest of the region studied, the predictions differed between models. The predicted distribution of *C. felis* based only on the occurrence of cytauxzoonosis cases in domestic cats was more restricted compared to the prediction incorporating presence of ticks and bobcats. Our results indicate that the ecological distribution of *C. felis* extends into areas where cases in domestic cats have not yet been reported, identifying the need for continued vigilance among veterinarians.

Noon–1:00 pm — LUNCH (DINING HALL)

LIBRARY

3. Oral Presentations (#12–18)
Chairperson/Projectionists
Amber Bartelt, Sam Houston State University Huntsville, Texas
Stephanie Staicer, Sam Houston State University Huntsville, Texas

1:00 pm

G 12. Effects of Patch Mosaic Burning on Ticks in Cattle Pastures. V. J. Polito[1], M. V. Reichard[1], K. Baum[2], S. Fuhlendorf[3], and M. Payton[4]. [1]Department of Pathobiology, Center for Veterinary Health Sciences, Oklahoma State University; [2]Department of Zoology, Oklahoma State University; [3]Department of Natural Resources and Management, Oklahoma State University; [4]Department of Statistics, Oklahoma State University.

Patch mosaic burning (PMB) is a regimen that applies spatially discrete fires with different burning intervals. Along with focal grazing of ruminants, these disturbances create a shifting mosaic of vegetation. Variation in plant community structure and composition has been implicated as a means of tick control by decreasing suitable tick habitat. We hypothesize that since ticks are sensitive to fluctuations in temperature and relative humidity within microhabitats, PMB will alter the vegetation structure enough to negatively affect tick populations. To test this, we used three PMB pastures and three control pastures to study tick abundance, cattle infestation and tick mortality. Flannel cloth panels were dragged through all pastures to estimate abundance of ticks. Abundance of ticks in both treatment and control pastures was variable and inconclusive. Levels of infestation on cattle were determined by counting the number of ticks on cows once a month from April to October. We found a total of 13,609 ticks in 2009, 2010, and 2011. Of these, 4,028 (29.6%) were on animals kept on treatment pastures whereas 9,581 (70.4%) ticks were on control animals. Significant differences were observed in months of peak tick activity. To study tick mortality, we placed adult *Amblyomma americanum* and *Dermacentor variabilis* in enclosures twice per year. Hobologgers placed at the center of their enclosures recorded temperature and relative humidity and tick mortality was monitored weekly. Significant differences were observed in environmental data; however, differences in tick mortality did not produce similar results which may be due to other confounding variables.

1:15 pm

G 13. Antibodies Reactive to *Rickettsia amblyommii* in Dogs Following Natural Exposure to Ticks. Anne Barrett and Susan E. Little. Department of Veterinary Pathobiology, Oklahoma State University Center for Veterinary Health Sciences.

To determine the risk of canine infection with SFG *Rickettsia* spp. following natural tick exposure, ten dogs determined to be free of evidence of exposure to or infection with tick-borne disease agents were exposed to ticks via weekly walks in a wooded area in northeast Oklahoma. After each walk, dogs were examined, the number and species of ticks present recorded, and dogs were then returned to outdoor kennels to allow the infestations and subsequent transmission of any pathogens to proceed. Whole blood and serum samples were collected from each dog twice weekly for 121 days and evaluated via PCR for evidence of *Rickettsia* spp. and via IFA for antibodies reactive to *R. rickettsii* and *R. amblyommi*. During the course of the study, dogs were infested with a total of 57-108 ticks over the entire 8 week infestation period (average tick infestation = 12.0 +/- 4.1); the great majority of the ticks present were *Amblyomma americanum* (90.5%), with a small number of *Dermacentor variabilis* and *A. maculatum* also identified. Although infection with *Rickettsia* spp. was not confirmed by PCR of whole blood , 10/10 dogs seroconverted to both *R. rickettsii* and *R. amblyommii*, with a maximum inverse geometric mean titer of 512.0 and 5,404.7, respectively. Maximum inverse titers to *R. amblyommii* ranged from 2,048-16,384 and were higher in every dog examined than maximum inverse titers to *R. rickettsii*. Taken together, our data suggest that, in areas where *A. americanum* is common, antibodies reactive to *R. rickettsii* may be due instead to infection with *R. amblyommii* or another closely related spotted fever group *Rickettsia*.

1:30 pm

G 14. Ancient Parasites Informing Modern Molecular Analysis. Lauren M. Cleeland[1], Mason Reichard[2], Raul Tito[1], Karl Reinhard[3], and Cecil M. Lewis[1]. [1]Dept. of Anthropology, Molecular Anthropology Lab, University of Oklahoma; [2]Dept. of Veterinary Pathobiology, Oklahoma State University; [3]Depts. of Earth and Atmospheric Sciences and School of Natural Resources, University of Nevada-Lincoln.

Archaeoparasitological investigations are most often employed to determine how ancient parasite-host relationships differed from the context of our current understanding of modern symbioses. Archaeoparasitological investigation can also be utilized to identify deficiencies in modern methodologies employed to address such questions. We performed both traditional morphological as well as modern molecular analyses on coprolite samples from the 1400 year-old La Cueva de Los Chiquitos Muertos archaeological site near El Zape, Mexico. In one of our samples, we morphologically identified a parasite egg as *Ascaris* from visualization on a microscope slide. From DNA extracted from the slide solution harboring the egg, we amplified and sequenced a fragment of 18s ribosomal RNA subunit gene known to be phylogenetically informative. From published comparative data, DNA sequences retrieved from the slide were more consistent with *Physaloptera* than *Ascaris*. We then extracted directly from the coprolite and cloned samples, which were also consistent with the initial findings. Our serendipitous finding of a putative *Physaloptera*, a relatively rare parasite by modern standards, highlights several weakness of parasitological research. 1) Morphological methods lack resolution for accurately identifying the taxonomic assignment of certain parasites. 2) The lack of reference samples for DNA, and the paucity of genetic sequence data, challenges designing effective chemistry for molecularly characterizing parasite species. 3) Because of the morphological and molecular limitations, there may exist a bias toward misdiagnosing more rare *Physaloptera* infections in favor of genera that are common and infect a large number of human hosts, such as *Ascaris*. The potential for this bias is of serious concern for understanding host infection and may misdirect treatment decisions.

1:45 pm

G 15. Helminth Community Structure in Nine Species of Sympatric Anurans from North Central Oklahoma. M. Suhail Vhora and Matthew G. Bolek. Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, 74078.

Oklahoma has a diverse anuran fauna; however, little information is available on the helminth communities that they harbor. This study documented the helminth community structure from 363 anurans representing nine species from four families. Frogs and toads were collected from March 2010 to September 2011 from four locations in Stillwater, Payne County, Oklahoma. Complete necropsies were performed, and a total of 2,996 larval and adult trematodes, 10,370 juvenile and adult nematodes, and 1,166 larval and 2 adult cestodes were recovered. Of the four collection locations, two had sympatric frog species and were used to compare helminth community structure. Communities differed in composition among host species. Host diet, size and habitat were important factors in structuring helminth communities among this amphibian assemblage. Larger host species had greater mean abundance, mean intensity, and species richness of helminths (H corrected = 85.68, $P < 0.0001$; H corrected = 17.44, $P = 0.004$; H corrected = 90.86, $P < 0.0001$; respectively) than smaller host species. Aquatic anurans were dominated by digenetic trematodes with complex life cycles or helminths that utilized aquatic intermediate/paratenic hosts, whereas the parasite communities of terrestrial anurans were dominated by nematodes and cestodes which were acquired directly from the soil or through feeding on terrestrial intermediate hosts. Semi-terrestrial and arboreal frogs had fewer adult digenetic trematodes and direct life cycle nematodes than did aquatic and terrestrial anurans. Although, helminth species composition varied at the local (pond) level in amphibian species that were sampled from multiple locations, the life cycle strategies of their helminths did not. Our work strongly suggests that the habitat of the amphibian host is the strongest predictor of its helminth community composition.

2:00 pm

G 16. Seasonal Occurrence and Community Structure of Helminth Parasites in Southern Leopard Frogs, *Rana sphenocephala*, from North Central Oklahoma. M. Suhail Vhora and Matthew G. Bolek. Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, 74078.

From May to September 2011, 74 southern leopard frogs, *Rana sphenocephala*, were collected from Teal Ridge, Payne County, Oklahoma U.S.A. Sixty-nine (93%) of 74 frogs was infected with 1 or more helminth species. The component community consisted of 11 helminth species, including 1 larval and 1 adult cestode, 2 larval and 3 adult trematodes, and 1 juvenile nematode and 3 adult nematodes. Of the 1,790 helminths recovered, 51% (911) were nematodes, 47% (842) were cestodes, and 2% (37) were trematodes. Seasonally, the average monthly temperature was lowest in May and highest in July, whereas monthly precipitation was highest in May and lowest during the first week of September. A significant positive correlation existed for percent of all helminths acquired by skin contact and monthly precipitation ($r = 0.95$, $P < 0.01$); whereas a significant negative correlation existed for seasonal precipitation and percent of helminths acquired through frog diet ($r = -0.95$, $P < 0.01$). In addition, statistically significant differences existed in the total abundance of helminths acquired by skin contact or through frog diet among monthly component communities of southern leopard frogs (H corrected = 23.56, $P < 0.0001$ for skin contact helminths; H corrected = 19.07, $P = 0.0008$ for helminths acquired by diet). Our results indicate that seasonal abiotic conditions have a major influence on the avenues for and constraints on the transmission of helminths with life cycles associated with water/moisture or terrestrial intermediate hosts. Thus, abiotic factors, such as precipitation or the lack of, are important factors in structuring helminth communities in amphibian hosts, and these may vary seasonally.

2:15 pm

G 17. The Influence of Anuran Host Species on Site Fidelity of *Halipegus occidualis*. Heather A. Stigge and Matthew G. Bolek. Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, 74078.

Preferential site selection of helminths within their definitive hosts is a well-documented phenomenon; however, factors that influence site selection by most helminth species remains poorly understood. In North America, species of *Halipegus* infect the digestive tract, buccal cavity, or eustachian tubes of amphibians. Previous field studies indicate that *Halipegus* species always demonstrate conserved site fidelity in their definitive amphibian hosts, but the site specificity of *H. occidualis* appears to be more variable than initially suggested because it has been reported from both under the tongue of green frogs and the stomach of several other anuran hosts. Therefore, it appears that the site specificity of *H. occidualis* might be dependent on the species of amphibian host. In order to investigate this variation in site fidelity, we established this life cycle in the laboratory. Laboratory reared snails were exposed to eggs from worms recovered from the stomach of naturally infected bullfrogs. Cercariae of *H. occidualis* were collected from the snails and exposed to laboratory reared microcrustaceans. Then, infected microcrustaceans were fed to Woodhouse's toads, Grey's treefrogs, and American bullfrogs. Adult gravid worms appeared under the tongue of toads and treefrogs 50-75 DPI; in contrast, gravid worms never appeared under the tongue of the bullfrogs but were removed from their stomachs. The site fidelity of *H. occidualis* within the bullfrog was further tested by transplanting gravid worms from under the tongue of experimentally infected amphibians into the mouths of uninfected bullfrogs, treefrogs, and toads. Gravid worms remained under the tongue of treefrogs for over 8 weeks. In contrast, gravid adults did not remain in the buccal cavity of bullfrogs for longer than 7 days. The transplanted worms were recovered from the stomach 14 days post-transplant. These results suggest that site fidelity of *H. occidualis* is dependent on the species of amphibian definitive host.

2:30 pm

G 18. Parasite Community Structure in 5 Species of Damselflies (Odonata: Zygoptera) from Teal Ridge, Stillwater Oklahoma.
Crystal M. Wiles and Matthew G. Bolek. Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, 74078.

Few ecological studies exist on parasite community structure in insects and compared to other invertebrate and vertebrate groups, insects have been largely ignored in ecological studies on parasite community structure. This is surprising because some insects such as odonates have become model systems for studies on host parasite interactions, and there is a desperate need for descriptive studies on their parasite community structure. In this study we examined 372 individual tenerals and/or adults of 5 species of damselflies (Argia apicalis, Enallagma civile, Ischnura hastata, Ischnura verticalis, and Lestes disjunctus australis) that varied in their development time in the water, temporal and flying season, size and phylogenetic relationships. All damselflies were collected from Teal Ridge a semi-permanent wetland located in Stillwater, Oklahoma during the fall and summer of 2010-2011 The parasite compound community of this odonate assemblage consisted of at least 7 taxa: 4 gregarines, 2 helminths, and 1 mite. A total of 441 individual parasites were recovered of which 59% were gregarines, 35% were mites and 6% were helminths. In the 3 most commonly collected damselfly species, the nematode Serpinema trispinosus was considered a generalist and infected all 3 species of damselflies. In contrast, a majority of mites, Arrenurus sp. (93%) and gregarines (87%) infected E. civile, and were considered specialists. Average parasite species richness was low among the 3 species of damselflies ranging from 0.17 + 0.38 (0-1) for I. hastata to 0.29 + 0.50 (0-2) for E. civile. However, in each case average parasite species richness was higher for female damselflies than males. There was no relationship in damselfly size and parasite abundance, intensity, or species richness among any of the damselfly species examined. However, I. hastata which begins flying in the late afternoon had the lowest parasite abundances and species richness among all damselflies sampled.

2:45–3:00 pm — BREAK

LIBRARY

4. Oral Presentations (#19–26)
Chairperson/Projectionists
Haley Dutton, Peru State College, Peru, Nebraska
Liz Matulka, Peru State College, Peru, Nebraska

3:00 pm

G 19. Using Gordiid Cysts to Discover the Hidden Biodiversity and Potential Distribution of Hairworms (Nematomorpha). Cleo Szmygiel[1], Ben Hanelt[2], Monica Papes[1], and Matthew G. Bolek[1]. [1]Department of Zoology, Oklahoma State University; [2]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 hairworms over large geographical areas. However, our recent studies indicate that cyst stages of hairworms may be the most commonly encountered gordiid life stage in the environment and can be used in generic and/or clade identification. These discoveries have given us the ability to investigate for the first time the biodiversity and distribution of these cryptic parasites. In this study, we sampled aquatic snails for the presence of hairworm cysts from 46 streams in Payne Co., Oklahoma where only a single species of gordiid (*Gordius robustus*) has been reported. 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 3 morphological types of gordiid cysts including *Paragordius varius*, *Gordius* spp. and *Chordodes*/*Neochordodes* spp. Based on our gordiid cyst presence data and in conjunction with environmental layers for Payne Co., we developed an ecological niche model using MAXENT to identify areas suitable for snail gordiid infections. The ecological niche model for Payne County successfully predicted present all localities of gordiid cysts in snails over a geographical area of 1,810 km^2. To test the predictability of our ecological niche model, we projected our Payne Co. model onto Lancaster Co. Nebraska for which snail gordiid cyst presence data was available. The projected model was able to account for 85% of the presence occurrence points. To our knowledge, this is the first ecological niche model attempted on a small geographical extent (county level) that recovered known locations successfully.

3:15 pm

<u>UG</u> 20. New Species of *Gordionus* (Nematomorpha: Gordiida) from Washington State. Begay, A.[1], M. G. Bolek[2], A. Schmidt-Rhaesa[3], and B. Hanelt[1]. [1]Department of Biology, University of New Mexico, Albuquerque, NM; [2]Department of Zoology, Oklahoma State University, Stillwater, OK; [3]Zoology Museum, University of Hamburg, Hamburg, Germany.

Gordionus is one of twenty extant genera within the phylum Nematomorpha, which consists of about 320 species. Fifty-six species of the genus Gordionus have been described from throughout the world, 7 of these from the contiguous United States. From 1998 to 2003, carabid beetles infected with hairworms were collected from 4 sites within the Hanford Nuclear Site and the Hanford Reach National Monument, Washington State. Pitfall traps with ethylene glycol were used to collect beetles; worms emerged partially from hosts. Thirty infected hosts were collected from 6 species and contained 2 new Gordionus species. Since the posterior end remained within the hosts, the morphological characters of this character-rich region were difficult to view using SEM. Species 1 had square-shaped polygonal areoles present in the anterior and posterior end. Interareolar structures are present in the two opposing sides of the areoles and postcloacal spines are present. Bristles are abundant in the anterior end and change direction in between areoles, and borders between bristles and areoles are present. Mid-body, canoe shaped areoles run parallel to the worm's longitudinal axis. Species 2 had square shaped areoles with polygonal-shaped neighbouring areoles. Interareolar structures are present mainly on opposing areoles; tubercles were present between areoles. Bristles, precloacal spines and adhesive warts are present. To confirm that these represent separate species, the mitochondrial barcoding region of cox1 was sequenced and analyzed. In addition, we used the cox1 gene to produce a phylogenetic hypothesis of the relationship of several Gordionus species. Including the new species presented here, known Gordionus diversity from the contiguous US has almost doubled over the last year, suggesting that there is much diversity to be described. Since many gordiids are collected in pitfall traps, usually as a byproduct of entomological collections, methods described here for microscopy and DNA extractions of worms fixed within the host by ethylene glycol will be of tremendous use.

3:30 pm

<u>UG</u> 21. Alteration of Fat Body and Ovary Development in the Female Cricket *Achaeta domesticus* Infected with the Hairworm *Paragordius varius* (Nematomorpha: Gordiida). E. M. Maldonado, J. D. Niforatos, and B. Hanelt. Center for Evolutionary and Theoretical Immunology, Department of Biology, University of New Mexico.

Unlike parasitoids, which kill their hosts, hairworms are inextricably linked to the health of the host until the very last moment of their symbiotic relationship. When hairworms have completed their development they rely on the host to move them to an aquatic environment. During their maturation, gordiids can grow to comprise more than half of their host's tissues suggesting that a large amount of damage is done to the host's organs although this damage is apparently not severe enough to interfere with the host's ability to deliver the worms safely to water. Since the impact of hairworms on host development has never been quantified, the aim of this study was to investigate, the effect of the developing parasite, on the mass of the host's major organs was investigated. Four week old juvenile *Acheta domesticus* crickets were infected with *Paragordius varius* cysts. Infected *A. domesticus* were dissected 5, 10, 15, 20, 25, and 30 days post exposure (DPE). For each time point, a control group was sham infected in parallel. All exposed crickets were screened for infection, and only those exposed crickets harboring worms were used. For each cricket, gonads and fat body were removed, dried, and weighed. Data from infected hosts at each time point was compared to uninfected crickets. The mass of the fat body significantly decreased during the late stages of infection. Surprisingly however, the fat body significantly increased within the first 10 days of infection and was found to nearly double that of the control group. Few infected crickets showed ovary growth within 20 DPE, and ovaries completely disappeared by 30 DPE. Although the ultimate demise of the ovaries and the decrease in the fat body mass was expected, the doubling of the fat body during early infection was unexpected. One explanation is that worms stimulated the growth of the fat body; however, it is also possible that by diverting energy away from the production of eggs, the fat body grew more than controls. The impact of these changes on the host's biology will be discussed.

3:45 pm

<u>UG</u> 22. Looking for Love In All the Right Places? How Hairworms (Nematomorpha: Gordiida) Find Potential Mates.
J. D. Niforatos, E. M. Maldonado, R. T. Sedam, and B. Hanelt. Center for Evolutionary and Theoretical Immunology, Department of Biology, University of New Mexico.

Behavioral parasitology usually involves the study of host manipulation by parasites, but few studies have investigated the behavior of the parasites themselves, especially their mating behavior. Freshwater gordiids or hairworms have a unique life cycle in which they complete their maturation within the definitive host, but delay mating until after being released by their host into water, where the free-living adult worms pair and mate. Since gordiids naturally occur singly in hosts and often rely on large and long river systems and areas with vast aquatic habitats, they must overcome the problem of release by the host distantly in space and time, which can result in worms finding themselves trapped in aquatic systems without mates. Despite this difficulty, gordiids are often found in mating knots consisting of several dozen individuals. To determine whether gordiids use chemical cues to find mates, we tested the attraction of worms to each other in an aquatic Y-maze. We used a field-collected species, *Gordius* sp., and a lab-reared species, *Paragordius varius*. In preliminary experiments, the only behavioral parameter measured was initial arm choice. However, in subsequent experiments, 3 additional behavioral parameters were measured: time spent in each arm over 10 minutes, first contact with the end of the maze, and final location after 10 minutes. *Gordius* sp. were only tested using the preliminary parameter, and males were found not to discriminate into which arm of the maze they moved. However, for *P. varius* males, the initial parameter tested significantly positive. Thus to better understand their behavior the additional 3 parameters were measured, and also showed significant differences, with the preference of choosing the side containing the female worm. In the future, female choice will also be tested. This study hints at the intriguing idea that some gordiids use chemical signals to find mates. In the future we hope to isolate the responsible chemicals.

4:00 pm

<u>UG</u> 23. Hanging Up on the Call for Love: Behavioral Modification of Male *Acheta domesticus* Crickets Infected with *Paragordius varius* (Nematomorpha: Gordiida). R. T. Sedam, W. L. Gordy, J. D. Niforatos, and B. Hanelt. Center for Evolutionary and Theoretical Immunology, Department of Biology, University of New Mexico and School of Engineering, University of New Mexico.

Male crickets call in order to attract the attention of females. This calling performance is costly to the male because 1) it is energetically costly, thus decreasing the energy allocated to reproduction, and 2) it attracts the attention of predatory species, which can decrease the cricket's reproductive potential to zero. These behaviors can also be detrimental to parasites, since the host uses energy which the parasite itself could use and in cases of predation can also severely decrease the parasite's reproductive potential. Thus, a mechanism to interfere with the host's courtship behavior could greatly benefit parasites. Field work has suggested that such a mechanism is found in male hairworm-infected crickets. The hairworm, *Paragordius varius*, infects crickets by being ingested as cysts within aquatic insects. Within 27 days, the 50µm long worm grows to 15–20cm; hosts can be infected with up to a dozen worms. Infection leads to castration since worms completely absorb testes. In this study, we examined the relationship between infection and cricket calling behavior. To test whether infected crickets change their calling behavior, we recorded twenty adult male crickets' calling rates before and after *P. varius* infection. Individual control and experimental (infected) crickets were recorded 2 days before and 2, 5, 10, 15, 20, and 30 days after infection. Each cricket's recording was done over the course of 8 hour periods during the scotophase. Each experimental cricket was dissected at the end of the experiment to determine infection status. Data show that infected crickets ceased calling within one to two weeks, whereas controls continued calling throughout the trial. These data show that hairworm infection causes hosts to put their calling display on hold. Although this behavioral change is thought to be beneficial to the parasite, it cannot yet be determined whether this change is due to the parasite-induced pathology or to an active parasite manipulation.

4:15 pm

G 24. Modeling Autoinfection in *Strongyloides stercoralis*. E. T. Jensen, B. Tenhumberg, and S. L. Gardner. Harold W. Manter Laboratory of Parasitology, University of Nebraska-Lincoln, Lincoln, NE, 68588-0514.

Strongyloides stercoralis is unique among nematodes for its ability to adaptively switch between free-living and parasitic lifecycles. Another unique attribute of the species is the ability to autoinfect its host, which can result in extremely long lived infections and enables small initial infections to potentially develop into hyperinfection in immunocompromised individuals. These factors, along with a wide array of reservoir hosts, make *S. stercoralis* a somewhat difficult parasite to manage. To the best of my knowledge, no one has yet published any mathematical models which account for these unique aspects of the life history of *S. stercoralis.* Such a model could provide insight into the nature of autoinfective bursts, shed light on cases of unexplained resistance, or potentially help illustrate the origins of parasitism in the Nemata. I have begun constructing simplistic and highly abstract mathematical models in hopes of eventually constructing a more all-encompassing and realistic model. I first created a time-independent model which optimizes the proportion of autoinfective larva and assumes no free-living cycle and an infinite host population. The results of this model demonstrate the necessity of including host population dynamics and the inadequacy of time-independent models when modeling for autoinfection. I then created a temporal model which incorporates host population dynamics and produces more realistic results. My remaining goals for this project are to include free-living lifecycles and seasonal oscillations in soil temperature and to find a more appropriate approach to quantifying fitness in these parasites.

4:30 pm

<u>UG</u> 25. Underwater Studies on the Feeding Behaviors of Some Centrarchid Hosts of *Huffmanela huffmani* (Nematoda: Trichosomoididae) in San Marcos Springs, Texas. M. Worsham and D. G. Huffman. Department of Biology, Texas State University.

The histozoic nematode now known as *Huffmanela huffmani* was first encountered during a classroom fish necropsy in the late 70's or early 80's. It was first thought to be a new species *Capillaria*, and was sent to Frank Moravec who recognized that it was a new genus and described it as the type species of the genus *Huffmanela* and later the subfamily Huffmanelinae. Since then, some 25 additional species have been added to the genus, all histozoic in various marine fish orders around the world, and none of which has known life cycles. Curiously, the eggs of these histozoic females are laid *in situ*, and usually have no way to exit the living host. We have determined that the eggs of *H. huffmani* not only survive a trip through the gut of a bass, but are then much more easily encouraged to hatch. But we have not been able to infect uninfected centrarchids with these eggs, suggesting that a small invertebrate on the sunfish menu is an obligatory intermediate host. The puzzle is further complicated by the extremely limited distribution *H. huffmani*, which is found only near the head springs of the San Marcos R, despite the widespread occurrence of its centrarchid hosts. Considering that *H. huffmani* is the only freshwater member of the genus, and that many of the unique endemic invertebrates of the San Marcos Springs are Cretaceous marine relicts, we conjecture that the mystery host is a previously unknown endemic detritivore, perhaps interstitial around the spring openings, and perhaps a relict polychaete from the Cretaceous seas. We are currently diving twice weekly to study the fish around the springs, and expect to report on some rapid necropsies of fish caught feeding at the springs, and also on surveys of invertebrates extracted from sediments around the openings.

4:45 pm

<u>G</u> 26. Pentastomes (Pentastomida: Cephalobaenida) Isolated from the Endangered Rattlesnake, *Crotalus durissus unicolor* from Arikok National Park, Aruba. Stephanie Staicer[1], Jeffrey M. Goessling[1], Autumn Smith-Herron[2], William I. Lutterschmidt[1,2], Tamara Cook[1], Howard K. Reinert[3], and R. Andrew Odum[4]. [1]Department of Biological Science and [2]Texas Research Institute for Environmental Studies, Sam Houston State University, Huntsville, Texas, USA; [3]Department of Biology, The College of New Jersey, Ewing, New Jersey, 08628, USA; [4]Department of Herpetology, Toledo Zoological Society, Toledo, Ohio, 43614, USA.

Due to the inadvertent road mortality of three *Crotalus durissus unicolor***,** we had the opportunity to necropsy and inspect their viscera (with permission of the Aruba Veterinairie Dienst and Parke Nacional Arikok). Upon necropsy, we found a total of 39 larvae and one adult of an unknown pentastome in the upper to middle respiratory tract. The parasites were excised, fixed in 10% formalin, and stored for transport in 70% Ethanol. The adult and larvae were examined with an Olympus SZX16 stereo microscope, and pictures were taken with an Olympus SDF Plapo camera. To aid in identification, the cephalothorax was removed, dehydrated in an ethanol series, cleared in xylene, and mounted with Damar Balsam. Measurements of the oral cadre, and 2 pairs of hooks of the cephalothorax were obtained. A total of seven morphological characters were selected for measurement to identify the adult specimen: total adult body length, adult body width at the widest point, estimated annulus number, adult mouth length, adult mouth width, adult pharynx width, and hook dimensions. These observations provide a new host and location record for pentastomes.

ORAL PRESENTATIONS FOR FRIDAY, APRIL 13, 2012 COMPLETED

5:00–6:00 pm – PRESIDENT'S RECEPTION (PAVILION ON THE LAWN) Wine and cheese social; in case of inclement weather this event will be in the Dining Hall.

DINING HALL

5. Poster Presentations (#27–32)

5:00–6:00 pm

Posters are available for viewing during the entire meeting in the Dining Hall. Authors of posters will be available for questions during the assigned poster session period.

27. Introducing a New Museum for Parasites – The Parasite Division of the Museum of Southwestern Biology at the University of New Mexico in Albuquerque. Sara V. Brant and Eric S. Loker. Department of Biology, Division of Parasitology, Center for Evolutionary and Theoretical Immunology, Museum of Southwestern Biology, University of New Mexico.

The Division of Parasitology is the newest addition to the Museum of Southwestern Biology at the University of New Mexico in Albuquerque. The Division, officially established in January 2011, is a research; training and education facility dedicated to the concept of 'integrated' research collections. In general, the Division is keen to use the parasite collection to play greater roles in understanding the ecology and evolution of infectious diseases, the impact of control programs on parasite evolution, and to promote the conservation of biodiversity, particularly of parasites. We will emphasize the study of parasites from the southwest of North America but collections from the world over will be accepted. The collection will contain necropsy facilities; both wet and dry processing areas specimen storage areas. The new space is slated for completion in late 2012. Additionally, the Division has genomic quality storage for frozen specimens. Using the MSB database Arctos (a multi-institutional, multi-collection database), information pertaining to parasites deposited in the Division will be integrated with information from their hosts, enabling more comprehensive studies of epidemiology, pathology, ecology and co-evolution of the parasites. For example, specimen data are mappable on Google Earth maps and specimens cited in publications are linked to those publications and specimens vouchering molecular sequence data are linked to the GenBank database. At present, the collection consists primarily of the Rausch Helminthological Collection (RHC), which is the personal research collection of Robert L. and Virginia R. Rausch. It represents over 50 years of continuous survey and inventory of vertebrate hosts and their parasites in biologically unique and sensitive regions throughout the world, with the primary focus on high latitudes in North America and eastern Siberia. The RHC, in excess of 60,000 lots of specimens, is unparalleled in scope and depth particularly for helminths of mammals, and is among the largest collections in the world. We look forward to working with you and encourage you to learn more how we can work together.

28. Observations on the Morphology, Behavior and Phylogenetic Position of Three Large-Tailed Cercariae from Planorbid Snails in New Mexico. D'eldra Malone, Sara V. Brant, Chrys A. Bochte, Jason M. Leonard, and Eric S. Loker. Department of Biology, Division of Parasitology, Center for Evolutionary and Theoretical Immunology, Museum of Southwestern Biology, University of New Mexico.

We provide observations on three unusual, large-tailed cercariae from planorbid snails found in New Mexico, two strigeids and an echinostome. The first two cercariae are from the snail *Gyraulus parvus* and the third cercaria is from *Helisoma trivolvus*. The first two cercariae closely matched with the European strigeid *Apharyngostrigea cornu* in 28S rRNA sequence comparisons, yet each is morphologically distinct. The first cercaria is unusual for its large overall size, long tail stem, a peculiar bulge in the tail stem just anterior to the furcae and its copepod-type swimming behavior. Morphologically the first cercariae most closely resemble *Cercaria bulbocauda* described by Miller (1927). The second cercaria is unusual for its inflated tail stem that has numerous spherical structures filled with refractile bodies. We know of no other cercariae with similar bodies in the tail stem. The third cercariae closely matched with an Old World echinostome *Petasiger phalacrocoracis* in ITS sequence comparisons. It is unusual for its hefty tail and slow S-shaped swimming behavior. These three cercariae differ from typically recovered strigeid and echinostome cercariae in morphology and size. We compare these species to what we typically recover from these snail hosts in New Mexico. Regardless, these unusual cercariae serve to accentuate the point that the cercarial tail is an organ capable of remarkable morphological and behavioral plasticity in response to selection at least these two groups of digenetic trematodes.

29. Swim Tunnel Endurance Studies on Minnows Artificially Infected at Varying Rates with Varying Intensities of *Centrocestus formosanus.* D. C. Huston and D. G. Huffman. Department of Biology, Texas State University.

Centrocestus formosanus is an invasive Asian trematode which infects the gills of about 50% of the of freshwater fishes exposed to its cercariae. Some species hyper-react to the metacercariae, and the resulting chondrocytic hyperplasia causes dramatic and permanent distortion of gill architecture with severe and sometimes lethal impairment of respiratory efficiency. Major fish kills have been reported in commercial fisheries practicing high-density monoculture, but despite the obvious damage reported for infected wild-caught fish, we can find no reports of fish kills attributed to *C. formosanus* in the wild. We conjecture that fish with respiratory impairment will be slower to flee from pursuing predators, and also more likely to vulnerably surface for air than their uninfected cohorts. This would increase the likelihood that infected fish would be preferentially selected by piscivores, thus preventing a news-worthy accumulation of dead fish. We have built a fish tunnel with which we plan to investigate the degree of swimming impairment caused by gill infection with *C. formosanus* in the important forage fish *Cyprinella venusta* and the endangered *Dionda diaboli*. Uninfected minnows will be exposed to varying densities of cercariae for varying durations and then forced to swim to exhaustion at 70% of their published maximum speed. Exhausted fish will be euthanized, preserved, and later necropsied to determine intensity of gill infection. Endurance in the tunnel will be then regressed against infection intensities and acquisition rates for all fish in order to develop a model that can be used to estimate degree of impact the parasite may be having on the forage fishes of wild fisheries it has invaded.

30. The Status of the Invasive Trematode *Centrocestus formosanus* as an Unexpected Threat to the Fishes of the Guadalupe River in Texas. J. Van Tine, D. C. Huston, and D. G. Huffman. Department of Biology, Texas State University.

Centrocestus formosanus is an invasive Asian trematode that infects the gills of numerous freshwater fishes, including the endangered fishes *Etheostoma fonticola* and *Dionda diaboli*, and uses the invasive Asian snail *Melanoides tuberculatus* as first intermediate host. Until recently, conservationists were comforted by the experimentally determined lethal thermal minimum of 18° C for the snail host, rendering the worm incapable of endangering wild fisheries native to temperate waters. But in 2009, Huffman found the snails in the adjoining Guadalupe R, and has since found 3 & 4 y.o. snails 18 km downstream and 4 km upstream from the confluence, some of which were shedding *C. formosanus* cercariae. We are currently assessing the geographic and taxonomic extent of the expansion of *C. formosanus* infection in the native fishes of the Guadalupe R. Preliminary examination of fish from Lake Dunlap (provided by Texas Parks and Wildlife in 2009 and again in 2011) suggest that the parasite is gradually spreading downstream among the native fishes of the Guadalupe R. We will report on these findings, as well as our future plans to refine these findings by intensively surveying the major fish groups of the Guadalupe R upstream and downstream of the confluence with the Comal R. We also plan to establish guidelines for the continued monitoring of the expansion of the parasite, and perhaps recommend guidelines to inhibit the rate of spread of the new temperature-insensitive morph of its snail host into other waters of Central Texas.

31. The Invasive Progression of the Malaysian Trumpet Snail (*Melanoides tuberculata*) and Its Parasites in the Comal and Guadalupe Rivers, Texas. S. Bushong[1], J. Lindholm[2], and D. G. Huffman[3]. [1]Vista Ridge High School; [2]En-tellect Environmental Services, Inc.; [3]Department of Biology, Texas State University.

The invasive Malaysian trumpet snail (*Melanoides tuberculata*) was first introduced into the Comal R of Texas decades ago, probably via aquarium dumps. Since then, there have apparently been several more introductions from different areas of Asia, as evidenced by the current abundance of several clonal morphotypes in the head waters of the Comal in the impounded headwaters of Landa Lake. Experimental studies on an unspecified mix of snail morphs had demonstrated that the snail begins to die off if exposed to temperatures ≤18°C for more than 30 d, leading conservationists to assume that the snail and its parasites posed no sustainable threat to surface-fed waters in temperate regions. But in the summer of 2009, *M. tuberculata* was found in several reaches of the Guadalupe R below its confluence with the Comal R in waters with winter thermal minima substantially colder than the snail's lethal thermal minimum. We have sampled snails from the Comal R irregularly for several years, and have found several species of trematode cercariae. The three trematode species that occurred with highest prevalence are Asian exotics with potentially severe wildlife or human pathologies (*Centrocestus formosanus*, *Philophthalmus gralli*, and *Haplorchis pumilio*). Our report will describe the historical and geographical patterns in the occurrence of the these snail parasites in the Comal R, and also provide alarming new data on range expansions of *M. tuberculata* and its parasites as far as 15 km downstream and 4 km upstream from the confluence with the Comal R during the unusually cold winters of fall 2009 through spring 2011.

32. Gizzard Helminths of Northern Shoveler (*Anas clypeata*) and Green-winged Teal (*Anas carolinensis*). Britani N. Lolley[1], Breanne Carr[1], Stacie M. Villarreal[1], Alan M. Fedynich[1], Autumn Smith[2], Pamela J. Ferro[3], Markus J. Peterson[4], David A. Butler[5], and Blanca Lupiani[3]. [1]Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX, 78363; [2]Sam Houston State University Department of Biological Sciences, Huntsville, TX, 77341; [3]Department of Veterinary Pathology, Texas A&M University, College Station, TX, 77843; [4]Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX, 77843; [5]Texas Parks and Wildlife Department, Bay City, TX, 77414.

Gizzard worms of the genera *Amidostomum* and *Epomidiostomum* are commonly found in waterfowl within the family *Anatidae*. Adult worms of both genera live under the koilin lining of the gizzard and feed on blood. Intense infections can lead to damage to the koilin lining and associated muscle and lead to gizzard dysfunction, emaciation, weakness, and potentially poor growth rates of juveniles. The Northern Shoveler (*Anas clypeata*) and the Green-winged Teal (*Anas carolinensis*) are two species within the *Anatidae* family that breed in northern North America and overwinter in southern areas of the United States. The objective of this study was to identify and determine prevalence and intensity of helminths occurring under the koilin lining of the gizzard in Northern Shovelers and Green-winged Teal, and evaluate the influence of host age and host sex on parasite populations. We collected 184 gizzards (85 Northern Shoveler and 99 Green-winged Teal gizzards) from hunter-shot birds during the 2007-2008 hunting season at the Justin Hurst Wildlife Management Area waterfowl check station in Brazoria County, Texas. Three species of nematodes were identified: *Amidostomum acutum, Epomidiostomum uncinatum,* and *Streptocara crassicauda*; as well as one species of cestode, *Gastrotaenia cygni*.

6:00-7:00 pm – DINNER (DINING HALL)

7:00–8:30 pm – SWAP BUSINESS MEETING AND PRESENTATION OF STUDENT AWARDS (LIBRARY)

9:00pm – ??? – SOCIAL HOUR(S) (DINING HALL)

LIBRARY

6. Oral Presentations (#33–36)
Chairperson/Projectionist
Shelby Steele, Peru State College, Peru, Nebraska
Eli Olsen, Peru State College, Peru, Nebraska

9:00 am

33. Two-year Survey of *Oxyspirura petrowi* In Northern Bobwhites from The Rolling Plains of Texas and Western Oklahoma. A. Bruno, S. M. Villarreal, A. M. Fedynich, L. A. Brennan, and D. Rollins[1]. Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX, 78363, USA; [1]Texas AgriLIFE Research, Texas A&M University, San Angelo, TX, 76901 USA.

Oxyspirura petrowi is an indirect lifecycle nematode found under the nictitating membrane of gallinaceous birds. *Oxyspirura petrowi* has been reported in northern bobwhites (*Colinus virginianus*) and scaled quail (*Callipepla squamata*) in the Trans Pecos ecoregion and Montezuma quail (*Cyrtonyx montezumae*) in the High Plains ecoregion. Recent research at the Rolling Plains Quail Research Ranch (RPQRR) has found *O. petrowi* to be a common parasite in bobwhites. Researchers speculate that the vision of bobwhites may be impaired by *O. petrowi*. Our objective was to determine prevalence, intensity, and abundance of *O. petrowi* in bobwhites using samples collected from the RPQRR during August 2010 (n = 51) and the Rolling Plains of Texas and western Oklahoma during August and October 2011 (n = 42). Bobwhites sampled during 2011 are a part of an ongoing three-year project to survey bobwhite parasites in the Rolling Plains. Overall, 40% of bobwhites were infected with 252 *O. petrowi*. Overall mean intensity of *O. petrowi* was 6.6 $\pm$ 10.2 (SD) (range: 1–46) and mean abundance of *O. petrowi* was 2.7 $\pm$ 7.2 (SD). Findings from this study will provide additional information about *O. petrowi* in bobwhites from the Rolling Plains of Texas and western Oklahoma.

9:15 am

34. The Distribution of the Invasive Trematode (*Centrocestus formosanus*) in West Texas, with Patterns of Infection in the Snail and Fish Hosts. D. C. Huston[1], K. S. McDermott[2], T. L. Arsuffi[3], K. G. Ostrand[4], and D. G. Huffman[1]. [1]Department of Biology, Texas State University; [2]Rocky Mountain Field Institute; [3]Field Station, Texas Tech University; [4]USFWS, NFHTC, San Marcos, Texas.

We examined the distribution and co-occurrence of the invasive trematode *Centrocestus formosanus* and its invasive snail intermediate host (red-rim melania, *Melanoides tuberculatus*), determined infection patterns in native and introduced fishes from ten spring systems in 1999 and again in 2011, and extended the previously documented range of the parasite. Collection efforts at four of the sampled spring systems (East Sandia Springs, Independence Creek, Big Bend-refugium pond, and Clear Creek) were negative for *M. tuberculatus*. San Felipe Creek and San Solomon, and Phantom Lake contained infected snails, and gills of some fishes were also positive for *C. formosanus*. At Diamond Y Springs, however, all examined snails and fishes were negative for *C. formosanus*, both in 1999 and 2011. Two additional springs systems sampled in 2011 (Pinto Creek and sites along the Devils River) also yielded fish that were positive for *C. formosanus*. Overall, 17 of the 21 fish species collected were positive for *C. formosanus* with prevalence and intensities high enough to endanger local populations of several fishes of concern, and to otherwise alter the structure of affected fish communities. The fish genera with highest prevalence were *Micropterus* and *Lepomis* followed in decreasing order by *Etheostoma*, *Dionda*, *Astyanax*, *Cichlasoma*, *Notropis*, *Cyprinella*, *Gambusia*, *Ictalurus*, and *Hypostomus*. We are developing plans for periodic monitoring of these sites for the future effects of the snail and its parasite.

9:30 am

35. Is *Echinostoma trivolvis* a Species Complex? Jillian T. Detwiler. Department of Biology, Texas A&M University.

With the aid of molecular markers, an increasing number of cryptic parasite species are being recognized. Although not always the case, species with large geographic distributions, low host specificity, and a history of systematic revision may be candidates for species complexes. I present the hypothesis that the trematode *Echinostoma trivolvis* may be comprised of several cryptic species. This species occurs throughout North America, uses a wide variety of second and definitive host species, and is morphologically similar enough to other *Echinostoma* spp. to have been the subject of misidentification. Further, *E. trivolvis* has been implicated as a disease agent in amphibians, and increasingly become the subject of ecological studies. However, for the reasons noted above and because of the paucity of comparative sequence data, it is not always clear if *E. trivolvis* (strictu senso) is the agent of disease. Both larval and adult stages of putative *E. trivolvis* were collected from several U.S. states, which increased the available number sequences for this previously inferred single species. Following phylogenetic analysis with mitochondrial and nuclear markers, evidence of 3 genetic lineages was found. In agreement with the species description, 1 lineage was host specific to the first intermediate host *Helisoma trivolvis*. In contrast, the other 2 lineages infected *Lymnaea* spp. All 3 lineages have been found in muskrat definitive hosts. Thus, molecular markers and host specificity data suggest that *E. trivolvis* may be a species complex. Future studies will focus on linking the morphology of each lineage to DNA sequences. Such data will provide the foundation to understand host specificity of these parasites and allow more accurate inference of disease agents and dynamics in amphibians or other wildlife.

9:45 am

36. Discovering the Hidden Biodiversity of Gordiids (Phylum Nematomorpha): Where are We and What are the Next Steps?
Matthew G. Bolek[1], Cleo Szmygiel[1], Erin Rogers[1], Ryan Shannon[1], Ben Hanelt[2], and Andreas Schmidt-Rhaesa[3].
[1]Department of Zoology, Oklahoma State University; [2]Department of Biology, University of New Mexico; [3]Zoological Museum, University of Hamburg.

Approximately 350 species of gordiids have been described worldwide from 19 extent and 2 extinct genera; but estimates suggest that only 15% of the hairworm diversity has been documented globally. Our lack of knowledge of the biodiversity of gordiids stems from the facts that most hairworm species have been describe based on random collections of single worms for which life cycles are unknown. However, over the last 5 years, our team has developed novel and unique collecting and culturing techniques for gordiids that overcome these shortfalls. First, our studies on the distribution of gordiids by using cyst stages indicate that nematomorph cysts in aquatic snails are the most common stages of gordiids to detect in the environment and are extremely easy to collect over large geographical areas. Second, cysts can be identified to genus/clade and can produce adult worms in the laboratory when fed to appropriate arthropod hosts. Third, our recent discovery of the ability of gordiid cysts from North American and African species of hairworms to survive freezing and produce viable adult worms when fed to laboratory reared hosts indicates that this technique will enable us to collect cyst stages of gordiids anywhere in the world and establish their life cycles in the laboratory. I will discuss our advances in these novel techniques along with their pitfalls which should allow us, for the first time, to move forward in discovering the hidden diversity of gordiids globally and test hypotheses on their distribution and biodiversity.

10:00 am – ADJOURNMENT

☺ ***Safe travels home! See you next year!*** ☺

Year	Rep. to ASP Council
1970-1973	Thomas C. Orihel
1973-1977	Walter M. Kemp
1977-1979	David G. Huffman
1979-1982	John Janovy, Jr.
1982-1987	Donald W. Duszynski
1987-1990	John R. Bristol
1990-1993	Danny Pence
1993-1996	Lynn Ann Hertel
1996-1998	Cynthia Chappell
1999-2000	Lee Couch
2000-2001	Scott L. Gardner
2001-2002	Richard E. Clopton
2002-2003	Scott L. Gardner
2003-2004	Michael A. Barger
2004-2005	Scott D. Snyder
2005-2006	Jerry L. Cook
2007-2008	Tamara J. Cook
2009-2010	Matthew G. Bolek
2011-2012	Richard E. Clopton

Year	Secretary-Treasurer
1969-1971	Betty June Myers
1971-1974	Gilbert A. Castro
1974-1977	Thomas G. Meade
1977-1980	David A. Becker
1980-1983	David G. Huffman
1983-1986	A. Alan Kocan
1986-1989	Lillian F. Mayberry
1989-1992	David T. John
1992-1995	Eric S. Loker
1995-2001	John Janovy, Jr.
2001-2005	John Hnida
2005-2011	Jerry L. Cook
2012-2015	Debra T. Clopton

President	Year	President-Elect
G. Robert Coatney	1969	Franklin Sogandares-Bernal
J. Teague Self	1970	Leroy J. Olson
Franklin Sogandares-Bernal	1971	Lionel Warren
Leroy J. Olson	1972	Betty June Myers
Betty June Myers	1973	Thomas C. Orihel
Clark P. Read (Donald V. Moore)	1974	Donald V. Moore
Robert E. Kuntz	1975	Gilbert A. Castro
Gilbert A. Castro	1976	Richard D. Lumsden
Richard D. Lumsden	1977	Calvin G. Beames, Jr.
John R. Seed	1978	Calvin G. Beames, Jr.
Calvin G. Beames, Jr.	1979	Donald W. Duszynski
Donald W. Duszynski	1980	Walter M. Kemp
Walter M. Kemp	1981	John E. Ubelaker
John E. Ubelaker	1982	Larry S. Roberts
Larry S. Roberts	1983	Robert O. McAllister
David G. Huffman	1984	Ben G. Harris
Ben G. Harris	1985	John R. Bristol
John R. Bristol	1986	Timothy P. Yoshino
Timothy P. Yoshino	1987	A. Alan Kocan
A. Alan Kocan	1988	John Janovy, Jr.
John Janovy, Jr.	1989	Marc H. Dresden
Marc H. Dresden (Lillian F. Mayberry)	1990	Lillian F. Mayberry
Lillian F. Mayberry	1991	George L. Stewart
George L. Stewart	1992	Cynthia L. Chappell
Cynthia L. Chappell	1993	David T. John
David T. John	1994	Jerry Y. Niederkorn
Jerry Y. Niederkorn	1995	Lee Couch
Lee Couch	1996	Steve J. Upton
Steve J. Upton	1997	Chris T. McAllister
Chris T. McAllister	1998	Patricia G. Wilber
Patricia G. Wilber	1999	Richard E. Clopton
Richard E. Clopton	2000	Brent B. Nickol
Brent B. Nickol	2001	Dennis J. Richardson
Dennis J. Richardson	2002	Sidney A. Ewing
Sidney A. Ewing	2003	Scott D. Snyder
Scott D. Snyder	2004	Tamara J. Cook
Tamara J. Cook	2005	Michael A. Barger
Michael A. Barger	2006	Scott L. Gardner
Scott L. Gardner	2007	F. Agustín Jiménez
F. Agustín Jiménez	2008	Kirsten Jensen
Kirsten Jensen	2009	John Hnida
John Hnida	2010	Matthew G. Bolek
Matthew G. Bolek	2011	Alan M. Fedynich
Alan M. Fedynich	2012	Charles K. Blend

The University of Oklahoma Biological Station is reached from U.S. Hwy. 377, just south of Willis, OK