SOUTHWESTERN ASSOCIATION OF PARASITOLOGISTS

54th Annual Meeting Program & Abstracts

April 23, 2021

Held Virtually via Zoom

Affiliate, American Society of Parasitologists

SOUTHWESTERN ASSOCIATION OF PARASITOLOGISTS

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AGENDA

Friday, April 23rd, 2021

8:00–9:00 am	President's Welcome & SWAP Business Meeting
9:00–9:15 am	Break
9:15–10:30 am	Session A Oral Presentations (#1–5)
10:30–10:45 am	Break
10:45–12:00 pm	Session B Oral Presentations (#6–10)
12:00–1:00 pm	Lunch Break
1:00–2:15 pm	Session C Oral Presentations (#11–15)
2:15–2:30 pm	Break
2:30–3:45 pm	Session D Oral Presentations (#16–20)
3:45–4:00 pm	Break
4:00–4:45 pm	Session F Oral Presentations (#21–23)
4:45–5:00 pm	Closing Remarks & Adjournment

*Abstracts with a "UG" are **Undergraduate** student papers in the competition; those with a "G" are **Graduate** student papers in the competition.

Unless noted, the speaker is the first author listed.

8:00–9:00 am President's Welcome & SWAP Business Meeting
President HEATHER STIGGE

9:00–9:15 am Break

9:15–10:30 am Session A: Oral Presentations 1–5

Chairpersons
RUSSELL LEE, Creighton University
ANNA SNIEZEK, Creighton University

9:15 am

(G) 1. **Thermal Preferenda of the Red-rimmed Melania (*Melanoides tuberculata*): Variation Among Clonal Lineages and Infection**. Matthew Donelon and David Huffman. Biology Department, Texas State University, San Marcos, Texas.

The invasive thiarid snail *Melanoides tuberculata* serves as host for more trematodes than any other snail. Local populations in central Texas host two invasive heterophyid trematodes which are impacting several fish species of concern. The reported vulnerability of the snail to winter thermal minima of Texas rivers was earlier expected to restrict its distribution to thermally stable spring waters like Comal Springs in New Braunfels. However, in 2009, *M. tuberculata* was found thriving in the connecting Guadalupe River many km from spring influence, despite recorded temperatures in those reaches remaining well below the published lethal thermal minimum of the snail for weeks. The invasive populations of the parthenogenetic snail are not composed of a single traditional species, but of several genetically distinct clonal lineages which were likely collected from thermally different environments in the snail's native range. Unfortunately, all previous researchers reporting on the thermal ecology of the snail ignored the clonal identities of experimental subjects. I searched the thermal biology literature hoping to find a device suitable for exploring the thermal preferenda of local clones of the snail. Unable to find a suitable device, I designed and constructed a water-filled thermal-gradient trough based on countercurrent heat-exchange theory and driven by a computer-controlled Peltier heat source at one end and a Peltier heat sink at the other end. The device is designed to produce a stable, linear thermal gradient ranging ±15 C from the 23 C waters of local springs. I will collect representative clones from Central Texas waters, and explore their thermal preferenda under varying conditions. I anticipate that the clones will differ in thermal preferenda, and that other factors (water quality, parasitized/uninfected, fasted/satiated, light/dark etc.) will alter some of the thermal responses.

9:30 am

(G) 2. **Mediterranean parasites in North America: Coccidia from introduced populations of the Mediterranean house gecko, H*emidactylus turcicus* and other species of *Hemidactylus***. Allison Bryant[1], Matthew Bolek[1], and Gabriel Langford[2]. [1]Department of Integrative Biology, Oklahoma State University, Stillwater, Oklahoma and [2]Department of Biology, Florida Southern College, Lakeland, Florida.

Hemidactylus turcicus, is native to the Mediterranean region of Africa, Asia, and Europe. However, it has been widely introduced across the world including the United States, were it was first reported in Florida in 1910 and have since colonized the southern United States. Beginning in the 1960s, the first records of H. turcicus from Oklahoma were due to intentional releases on university campuses, including Oklahoma State University, and currently *H. turcicus* is found in 55 of 77 counties in the state. Although a number of studies have documented parasites of *H. turcicus* throughout its introduced range, little information exists on the coccidian parasites of this gecko. We sampled geckos from the OSU campus and examined their fecal samples for coccidian oocysts. Twenty percent of geckos shed ellipsoid tetrasporocystid oocysts with a smooth bi-layered wall. Oocysts, contained a polar granule, but a micropyle and residuum were absent. Sporocysts were ellipsoid and without stiedal or substiedal bodies. Sporocysts contained a residuum composed of numerous granules in a spherical mass and 2 sporozoites. These oocysts were most similar to the description of *Eimeria lineri* (*Acroeimeria lineri*) previously reported from *H. turcicus* in the United States, Egypt, Israel and Turkey and from *H. mabouia*, from South Africa. Additionally, 20% of geckos shed ellipsoid polysporocystid oocysts with a smooth bi-layered wall. Numerous granules were present within oocysts, but a micropyle was absent. The number of sporocysts per oocyst ranged from 8 to 12. Sporocysts were subspherical and contained a residuum composed of scattered granules. These oocysts were most similar to species of *Adelina* which infect invertebrate hosts and should be considered pseudoparasites of geckos. This is the first report of *Acroeimeria lineri* from Oklahoma. However, a recent study on coccidia of *H. turcicus* from Egypt suggested that *A. lineri* may represent a complex of cryptic species. As a result, we are expanding our survey and examining Mediterranean house geckos and two other introduced species of *Hemidactylus*, from Florida for coccidian infections. To get a better understanding of the diversity of coccidian parasites in species of *Hemidactylus*, we will utilize DIC microscopy techniques for oocyst morphology, histological techniques for coccidian development in geckos, and molecular techniques for barcoding coccidians.

9:45 am

(UG) 3. **A survey of gregarine species parasitizing the differential grasshopper, *Melanoplus differentialis*, in an urban environment in eastern Kansas, U.S.A.** Jordan A. Xufuris and J. J. Cielocha. Department of Biology, Rockhurst University, Kansas City, Missouri, U.S.A.

Gregarines are a diverse group of protozoan parasites that parasitize marine, freshwater and terrestrial invertebrates. Gregarines of insects are especially diverse. The insect order Orthoptera includes grasshoppers, katydids, locusts and crickets. Several past studies have focused on gregarines of orthopterans, but few are from the Americas. The differential grasshopper, *Melanoplus differentialis*, has been reported to host a gregarine in the genus *Amoebogregarina* in Illinois, Nebraska, and Ohio throughout the 1900s. Twenty-eight individuals of *M. differentialis* were collected by hand from a fence line along a public walking trail in Overland Park, Kansas, U.S.A. in the fall of 2019. Grasshoppers were stored in 1-gallon plastic containers with the host plant and dissected 24 to 48 hours after collection. Alimentary canals were removed, dissected, and observed for gregarine infection. Specimens were fixed, stained, and mounted on glass slides for observation under a compound microscope. Two gregarine species were found parasitizing *M. differentialis* in this study. One species is consistent with that previously described from this host, *Amoebogregarina* c.f. *nigra*. The second is presumably a new species of *Quadruspinospora*. It differs from the other known members of this genus by a number of morphological features such as total length and maximum width, but also in its developmental sequence. Here we report the differences and diversity of gregarines in the genus *Quadruspinospora* and discuss the taxonomic history and present status of this genus. Future work will focus on obtaining molecular sequence data to better determine the phylogenetic placement of these taxa among the Eugregarinorida.

10:00 am

(UG) 4. **Prevalence of *Toxoplasma gondii* among cat populations in Southeast Nebraska**. Tyra Mollhoff, Noah Kasbohm, and Gul Ahmad. Department of Natural Sciences, School of Arts & Sciences, Peru State College, Peru NE 68421.

Domestic cats (*Felis catus*) are beloved companions and important animals that many humans live close to or encounter every day. However, cats are also profoundly important carriers for many zoonotic diseases. One of the unicellular eukaryotic parasites which cause a deadly disease in human and are transmitted via cats is toxoplasmosis. The causative agent of this debilitating disease is the protozoan parasite *Toxoplasma gondii*. Currently some 16% of the United States population is seropositive for toxoplasmosis while up to 2% of the mentally retarded children are reportedly born to mothers who were infected with *Toxoplasma gondii* during the pregnancy. Keeping in mind the high prevalence of this zoonotic disease among our population it was decided to investigate the prevalence of this parasite among the cat population. This survey was tailored to determine the percentage of cats which are harboring *T. gondii*. Fresh fecal samples were collected from individual houses and outdoor cats in Southeastern Nebraska. The samples were transported in vials of 10% formalin to the laboratory. After filtration and centrifugation, the fecal material was re-suspended in diluted ethyl acetate. Following a vigorous shaking process and a second round of centrifugation, the fecal material was resuspended in water. The identification of the parasite was performed under light microscopy. Overall, 77% of the fecal samples were infected with one or more parasites. The most prevalent protozoan parasite (50%) found was *T. gondii* followed by *Entamoeba histolytica* (24%), *Chilomastix mesnili* (12%), *Iodamoeba buetschlii* (10%), and *Endolimax nana* (3%). One cat was also infected with *Giardia*.

10:15 am

(UG) 5. **Possible use of a terrestrial insect as a paratenic host for the horsehair worm, *Chordodes morgani***. Jessica Jagelski and John Shea. Biology Department, Creighton University, Omaha Nebraska.

Horsehair worms [Nematomorpha] parasitize several insects including crickets, grasshoppers, and roaches. Their life cycle starts with aquatic eggs that hatch into larvae and encyst in aquatic invertebrates, which serve as paratenic hosts transferring the aquatic stage to the terrestrial environment when the aquatic host metamorphoses into a flying adult. When consumed by a terrestrial arthropod, the cysts develop into juvenile hairworms that, after maturing to adults, manipulate the host into entering water. The life cycle of the hairworm, *Chordodes morgani*, remains poorly studied. Previous research found that wood roaches (*Parcoblatta virginica*) serve as its definitive terrestrial host in Nebraska while mayflies [Heptageniidae] can serve as its aquatic paratenic host. Although roaches consume dead mayflies, they also consume other dead terrestrial insects. If these insects first consumed an infected mayfly, then they could serve as an additional paratenic host, transferring hairworm cysts from the mayfly to the wood roach. Alternatively, these terrestrial insects could be dead-end hosts, failing to successfully infect wood roaches. To test this, we collected naturally infected mayflies (Heptageniidae) from a Nebraska creek known to harbor *C. morgani*. We dissected 42 mayflies and counted the number of cysts in each mayfly. We starved 42 lab-reared beetles (*Tenebrio molitor*) for one week before exposing them to mayflies with a known number of cysts. Two weeks post exposure, we removed the intestines from each beetle and examined them for cysts. If cysts were found, the intestines were fed to lab-reared wood roaches (*Parcoblatta fulvescens*). Of the 20 wood roaches exposed to beetle intestines with *C. morgani* cysts, none yielded horsehair worms, suggesting that *Tenebrio molitor* does not act as a paratenic host.

10:30–10:45 am Break

10:45–12:00 Session B: Oral Presentations 6–10

Chairperson
EMMA MARTINEZ, Rockhurst University

10:45 am

(G) 6. **Host specificity and population genomics in marine tapeworms (Eucestoda: Trypanorhyncha)**. Kaylee S. Herzog and Kirsten Jensen. Department of Ecology & Evolutionary Biology and Biodiversity Institute, University of Kansas, Lawrence, Kansas.

Since the earliest days of DNA sequencing, cestodologists have puzzled over the link between host specificity and genetic diversity in tapeworms. To date, however, population genomic studies in the group have been restricted to a handful of species of medical and veterinary importance, and one species from freshwater teleosts. To explore the role of host specificity in population genomic structure, we designed a study that leverages the wide range of specificities of trypanorhynchan tapeworms for their definitive shark and ray hosts and the power of next generation multi-locus sequence data in combination with a comprehensive global sampling strategy. We hypothesize that increased host specificity will be correlated with a higher degree of population genetic structuring by host and geographic locality, and that tapeworms recovered from the same host individual will be more closely related than will tapeworms recovered from different host individuals of the same species, or different species of hosts. This study will (1) measure population-level genomic diversity in marine tapeworms, (2) assess the relative roles of host specificity and geographic distribution in marine tapeworm population-level genomic structure, and (3) provide an estimate of relatedness among tapeworms collected from a single host specimen. Two species representing both trypanorhynchan suborders were targeted for a multiplex shotgun genotyping (MSG) approach. For *Rhinoptericola megacantha* (suborder Trypanobatoidea), 40 tapeworms were sequenced from 19 ray hosts representing three species of Rhinoptera from four geographic localities in the northern Atlantic Ocean. For *Callitetrarhynchus gracilis* (suborder Trypanoselachoidea), 48 tapeworms were sequenced from 17 shark hosts representing six species in three genera from seven geographic localities in the Atlantic and Pacific oceans. Data processing is underway, and the results of this study are expected to lay an initial foundation upon which future population-level studies on marine tapeworms can build to address, for example, questions regarding infection dynamics.

11:00 am

(G) 7. **Unraveling the role of ostracod and snail hosts in turtle acanthocephalan life cycles**. Ryan Koch and Matthew Bolek. Department of Integrative Biology, Oklahoma State University, Stillwater, Oklahoma.

It is assumed that most species of turtle acanthocephalans in the genus *Neoechinorhynchus* infect ostracods as intermediate hosts and turtles as definitive hosts in their life cycle. In addition, *Neoechinorhynchus emydis* has been reported from ostracod, turtle, and snail hosts. However, it is currently unclear what species of ostracods serve as intermediate hosts for most species of turtle acanthocephalans and how snail hosts become infected with *N. emydis*. To better understand of these life cycles, we first surveyed red-eared slide turtles, as well as four species of ostracods and two species of freshwater snails for acanthocephalans and used molecular barcoding to identify juvenile acanthocephalans from ostracod and snail hosts to the species level. Second, we exposed two species of ostracods (*Physocypria* sp. and *Cypridopsis* sp.) and the freshwater snail (*Planorbella* cf. *P. trivolvis*) to eggs of four species of turtle acanthocephalans (*N. chrysemydis, N. emydis, N. emyditoides* and *N. pseudemydis*) in the laboratory. Although eggs of all four species of acanthocephalans hatched in both species of ostracods, development to the acanthella and/or the cystacanth (infective stage) only occurred in *Physocypria* sp. In contrast, eggs of the four species of acanthocephalans never developed in laboratory exposed snails, strongly suggesting that snails become infected with *N. emydis* by ingesting ostracods. These laboratory observations support our field surveys in that only a single species of ostracod (*Physocypria* sp.) was infected with multiple species of juvenile turtle acanthocephalans; whereas both species of freshwater snails were infected with juvenile *N. emydis*.

11:15 am

(UG) 8. **Change in horsehair worm prevalence and intensity in eastern Nebraska since 2001**. Duc Khanh Nguyen Nguyen (Eric) and John Shea. Biology Department, Creighton University, Omaha, Nebraska.

Horsehair worms [Nematomorpha] have a complex life cycle requiring many hosts to grow and mature. The larvae, after hatching from eggs, encyst inside a paratenic host. When this host is eaten by a terrestrial definitive host, the parasite grows into a juvenile worm. Once the horsehair worm matures, it manipulates the host to enter the water where it emerges, mates and lays eggs. The larvae also encyst in aquatic snails, which allows for the detection of horsehair worms by collecting and dissecting snails for cysts. Because of their complicated life cycles, we predict that the presence of horsehair worm cysts will serve as an indicator of water quality. To test this, we expanded a 2001 study to determine the prevalence and intensity of horsehair worm cysts in 20 snails collected from 50 sites, varying in water quality. We dissected each snail and counted horsehair worm cysts. A YSI probe collected data on temperature, pH, dissolved oxygen, nitrate, and salinity from each site. Current data is compared to 2001 data and correlated with water quality data. Of the 14 sites for which we have complete data, we failed to find horsehair worms at two sites where they were detected in 2001. We detected the presence of horsehair worms at one site where they were not detected in 2001. One site did not have cyst-infected snails in 2001 or during our current sampling. Two sites experienced a decrease of more than 50% in the prevalence of cyst-infected snails. The remaining 8 sites experience either no change or very little change, suggesting that horsehair worms persist over time and tolerate anthropogenic disturbances. A more complete data set will allow us to predict the presence and absence of horsehair worms among the 50 sites.

11:30 am

(UG) 9. **Investigating the immune response elicited by the ray species *Urogymnus asperrimus* 1 (Elasmobranchii: Batoidea) caused by the attachment of a species *of Tetragonocephalum* (Cestoda: Lecanicephalidea)**. Emma Martinez and J. J. Cielocha. Department of Biology, Rockhurst University, Kansas City, Missouri U.S.A.

The genus *Tetragonocephalum* is one of dozens of genera known to parasitize the digestive track of rays in the family Dasyatidae (Elasmobranchii: Batoidea). Recent phylogenetic and systematic studies support the recognition of 12 valid species in the family Tetragonocephalidae. Members of this family possess unique morphological features, including a non-retractable apical organ that attaches intimately to the host. This host-parasite interface allows for questions regarding the hosts' immune response to the tapeworm to be investigated. Members of this family have never been investigated at the histological level, and there are limited data for other Lecanicephalideans. Specimens of *Tetragonocephalum* sp. were collected from *Urogymnus asperrimus* 1 from the Solomon Islands. A subset of these specimens were prepared for histological sectioning. In situ scoleces were sectioned longitudinally and stained with H&E. Preliminary results from the study indicate penetration into the mucosal epithelium and through the lamina propria. Additionally, a subset of in situ scoleces were stained with either Periodic Acid Schiff (PAS) and Hematoxylin or Trichome. PAS was used to detect secretory cells in the tapeworm scolex and host white blood cells (e.g., basophils). Detection of basophils would demonstrate an immune response to the presence of *Tetragonocephalum* sp. Trichrome is used to identify specific cytoplasmic elements. Positive results with Trichrome alluded to differences in muscular and collagenous tissue around the location of host-scolex interface. An increase in the presence of collagen and fibrous tissue indicated the development of an aggregate or potential tumor-like response by the host. This process allows for the identification and characterization of potential pathology caused by the attachment of *Tetragonocephalum* sp. to its host and any potential host-immune response elicited by the parasite. This study has provided greater insight into the host-immune response in the elasmobranch tapeworms.

11:45 am

(UG) 10. **Environmental factors affecting the emergence of *Chordodes morgani* and host growth in *Parcoblatta fulvescens***. Matt Lawler & Russell Lee (co-presenters), and John Shea SJ. Biology Department, Creighton University, Omaha, Nebraska.

The horsehair worm [Nematomorpha], *Chordodes morgani*, wraps around submerged branches where it deposits its eggs. Larval mayflies and aquatic snails become infected with the cyst stage when they graze upon these branches. When mayflies metamorphose into adults, they transport the cysts from the aquatic environment to the terrestrial environment. Wood roaches become infected when they consume these mayflies. In the lab, *C. morgani* took an average of 70 days to mature and emerge from wood roaches (*Parcoblatta fulvescens*) as adults. In the field, we find adult worms in July, suggesting that the roaches were infected two months earlier. However, lab conditions do not replicate field conditions, especially in terms of temperature and food availability. Further, our preliminary study found that the growth rate of infected roaches (n=21) was significantly greater than sham infected roaches (n=22) ($p < 0.01$). To test how both diet and temperature impact roach growth rate and timing of worm emergence, we sorted roaches into four categories: room temperature-starved, room temperature-fed, cold temperature-starved, and cold temperature-fed. The sample size for each category is 14 with half of the roaches exposed to *C. morgani* cysts and the other half sham-infected. All roaches were individually housed with an autoclaved piece of bark and moistened cotton ball. Fed roaches received pellets of dry cat food. Cold temperature roaches were placed in a -20 degrees Celcius refrigerator. We measured the length of all roaches each week. Beginning at 60 days post-exposure, we will dunk roaches in water each day to confirm infection. We predict that room temperature-fed roaches will have the highest rate of horsehair worm emergence and that their growth percentage will be higher than the other groups. Results from this study will help us predict the timing of the life cycle of *C. morgani* in field conditions.

12:00–1:00 pm Lunch

1:00–2:15 Session C: Oral Presentations 11–15

Chairperson
BEN PAUL, Creighton University

1:00 pm

(G) 12. **The fauna of *Tetragonocephalum* (Cestoda: Lecanicephalidea) in species of the whipray genus *Pateobatis***. Isabel A. M. Pen and Kirsten Jensen. Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, KS.

The lecanicephalidean tapeworm genus *Tetragonocephalum* currently comprises 12 valid species. Species in this genus are easily identifiable among lecanicephalideans based on their possession of a unique combination of features: a non-retractable, muscular apical organ; a dumbbell-shaped, rather than saccate, uterus; and a large, rather than small, genital atrium. Valid species of *Tetragonocephalum* have been described from whiprays (Dasyatidae) in seven species representing the genera *Brevitrygon*, *Himantura*, *Maculabatis*, *Pastinachus*, and *Urogymnus*, all from the Indo-Pacific region. In addition, an as of yet undescribed species has been reported from a species of *Pateobatis*. Extensive new material from Australia, the Solomon Islands, Japan, Taiwan, Vietnam, Sri Lanka, India, Egypt, Mozambique, and the island of Borneo has allowed for a more complete assessment of the host associations of *Tetragonocephalum* overall. Selected worms were prepared as whole mounts for examination with light and scanning electron microscopy and as histological sections. The new material suggests that species of *Tetragonocephalum* parasitize at least an additional 13 species of whiprays. The new host records include, for the first time, species in the genera *Dasyatis*, *Hemitrygon*, *Neotrygon*, and *Taeniura*. More detailed study of the fauna of three of the five species of *Pateobatis* indicates that *Pateobatis fai*, *P. jenkinsii*, and *P. uarnacoides* are parasitized by four, three, and two species, respectively. These and published data hint at the possibility of as many as two to four species of *Tetragonocephalum* per host species. Moreover, preliminary molecular data from a small subset of species suggest that congeners in the same host species are not each other's closest relatives.

1:15 pm

(UG) 11. **Phylogenetic patterns of *Posthodiplostomum* metacercariae in Texas**. Josue Zuniga[1], Dr. Isabel Blasco-Costa[2], and Dr. Kristen Herrmann[1]. [1]Department of Biological Sciences, Tarleton State University, Stephenville, Texas and [2]Natural History Museum of Geneva, Geneva, Switzerland.

Posthlodiplostomum is a trematode genus that possesses a 3-host life cycle and is most frequently encountered in second intermediate hosts—primarily freshwater fish, where they exist as metacercariae. This developmental stage can be detrimental to the health of its second intermediate host, due in part to their forceful entry and migration through the tissues of these fish, often cases leading to hemorrhaging and bacterial infections, and secondly due to the ability of these metacercariae to form multiple cysts in tissues of vital organs. Given how widespread and common *Posthodiplostomum* infections are within freshwater fishes, it is important to understand the infection dynamics of this genus. However, trematode larvae are difficult to identify at the species level, and identification issues can be further exacerbated by a phenomenon known as cryptic diversity, in which species share morphological characteristics but differ molecularly. The objective of this study was to determine the phylogenetic diversity of *Posthodiplostomum* metacercariae from various fish host species in Texas. We obtained specimens from the tissues of four fish species collected from other studies. We sequenced two molecular markers, internal transcribed spacer (ITS) regions of rDNA and the mitochondrial cytochrome c oxidase 1 gene (COI). Both Maximum Likelihood and Bayesian analyses were conducted, using RAxML and MrBayes, respectively. Our results demonstrate a host specific pattern of association, corroborating host-specificity reported by studies in northern North America. Further, metacercariae collected from *Gambusia affinis* fall within a single lineage, distinct from other species in the *Posthodiplostomum-Ornithodiplostomum* clade. Additional phylogenetic analysis of the nuclear 28S gene will allow us to determine if larvae found in *G. affinis* represent a distinct lineage of *Posthodiplostomum*.

1:30 pm

(G) 13. **Integrative Taxonomy of *Posthodiplostomum***. Kari Waddle[1], Isa Blasco-Costa[2], Autumn Smith-Herron[3], and Kristin Herrmann[1]. [1]Department of Biological Sciences, Tarleton State University, Stephenville, Texas; [2]Natural History Museum of Geneva; and [3]Texas Invasive Species Institute, Sam Houston State University, Huntsville, Texas.

Parasitologists have been operating under the assumption that there is a single representative species of *Posthodiplostomum* found in North America. Metacercariae in fish are more easily accessible, but lack of morphological differentiation at this life stage makes determining species unlikely. However, phylogenetic studies conducted on *Posthodiplostomum* metacercariae in fish hosts have found genetic differences, showing host and tissue specificity within *Posthodiplostomum*. Our study incorporates integrative taxonomic methodology to delineate species of *Posthodiplostomum* based on adult specimens. *Posthodiplostomum* specimens were obtained from nuisance herons at a Texas fish hatchery by their biologist. A subset of specimens was relaxed and fixed in steaming saline, then tissue was removed and preserved in 100% ethanol for DNA extraction. The remainder of each specimen was stored in 70% ethanol for staining and morphological measurements. After DNA extraction, gene-specific primers were used on two genes (CO1 and ITS) amplified by PCR. After preliminary analysis, a subset of specimens will be sequenced for 28S. For morphological analysis, specimens were dehydrated in a graded ethanol series, stained, and cleared with xylene then mounted in Canada Balsam. Various measurements are being recorded for morphological comparison. Maximum likelihood and Bayesian phylogenetic analysis is being conducted for COI and ITS sequences from our study and those obtain from GenBank. Currently, our study has indicated four distinct morphologies that line up with species descriptions for *P. centrarchi, P. nanum, P. minimum*, and *P. macrocotyle*. Additionally, we have obtained one morphological specimen that has not matched a species description, which gives rise to the possibility of a new undescribed species. Further, preliminary phylogenetic analysis of COI indicates that this specimen matches metacercariae obtained from Western mosquitofish, *Gambusia affinis*. Thus far, preliminary data seems to be revealing unrecognized and undocumented diversity within *Posthodiplostomum* in North America.

1:45 pm

(G) 14. **Parasites of White Crappie (*Pomoxis annularis*) in the Concho Valley of West-Central Texas**. Blake Thornton and Nicholas Negovetich. Biology Department, Angelo State University, San Angelo, TX.

During the fall and winter of 2019, trap net surveys were conducted on the South Concho River, Lake Nasworthy, O.C. Fisher Reservoir, and Twin Buttes Reservoir in San Angelo, TX. The trap net surveys were conducted in conjunction with Texas Parks and Wildlife Inland Fisheries San Angelo, who were interested in estimating population size and structure in the 4 aquatic systems. These surveys reported here were conducted to collect and report the parasites present in white crappie (*Pomoxis annularis*) in the Concho Valley. The fish (n=113) were frozen upon collection and necropsied in the summer of 2020. Additionally, the otoliths were removed and analyzed to compare age-specific rates of infection. Four parasite species were recovered: *Cleidodiscus* sp., *Camallanus oxycephalus*, *Contracaecum* sp., and *Argulus longicaudus*. The intensity and prevalence of each parasite species was reported and compared between aquatic systems. The prevalence of *Cleidodiscus* sp. was highest in the South Concho River, the prevalence and intensity of *Camallanus oxycephalus* was highest in Lake Nasworthy, and the prevalence and intensity of *Contracaecum* sp. was highest in O.C. Fisher Reservoir. No downstream accumulation of parasite prevalence or intensity was observed.

2:00 pm

(UG) 15. **Prevalence of intestinal parasites among dog populations of Nebraska, Kansas, and Missouri**. MaKayla Nagengast, Erin M. Bates, Macheala Cowman, and Gul Ahmad. Department of Natural Sciences, School of Arts & Sciences, Peru State College, Peru Nebraska 68421 USA.

Dog (*Canis familaris*) is more than just a family pet. Humans and their dogs not only share a close familial relationship, but also share parasites. As a result, the incidences of direct zoonosis infections and anthroponosis infections could possibly increase significantly. The present survey was carried out using stool samples from sheltered dogs from Southeastern Nebraska kennels and patients from Animal Health Center in Falls City, NE, to determine the rate of parasitic infections. Fresh fecal samples were collected individually from all animals and brought to the laboratory. Two forms of fecal flotations were used in this study. The first, a fecal specimen was emulsified in 10% formalin. After filtration and centrifugation, it was suspended in diluted ethyl acetate. Following vigorous shaking and centrifugation the pellet was re-suspended in saline. For the second method, the fecal sample was frozen in the freezer at – 20 ℃ until time of processing. The sample was then thawed and suspended into diluted zinc sulfate. Filtration was then performed and centrifugation was done. Three separate slides were made. Identification of parasite eggs or cysts was done under light microscopy, which is still the gold standard for diagnosis of parasitic infections. In the study with formalin, the result of light microscopy was astounding. A total of 56% of the fecal samples were infected with one or more of the parasitic infections. Zinc sulfate only showed a 28% positivity rate among population of dog examined. The most abundant egg load (39.34%) in dogs' fecal sample was identified as those of *Toxicara canis* followed *Trichuris vulpis* (15.24%), *Dipylidium caninum* (12.88%). Among the protozoan parasites, *Endolimax nana* were seen in 10% of the fecal samples tested, followed by *Giardia intestinalis*, which were present in 1.34% of the population of dogs investigated in this study. Coccidia showed a small percentage of infection (1.03%). The detailed results of the current study will be discussed at the meeting.

2:15–2:30 Break

2:30–3:15 Session C: Oral Presentations 16–20

Chairperson
RYAN KOCH, Oklahoma State University

2:30 pm

(UG) 16. **A comprehensive study of parasites of the Texas State Bison Herd: part 2**. SaraBeth Boggan[1], Kristin Herrmann[2], Donald Beard[3], and Heather Mathewson[1]. [1]Wildlife, Sustainability, and Ecosystem Sciences Department, Tarleton State University, Stephenville, Texas; [2]Biological Sciences Department, Tarleton State University, Stephenville, Texas; [3]Caprock Canyons State Park, Texas Parks and Wildlife Department, Austin, Texas.

Parasites can have a significant effect on the typical growth, weight gain, and milk production of hoofstock. Therefore, infections are often managed with common antihelminthics. Texas Parks and Wildlife Department (TPWD) biologists manage the Texas State Bison herd at Caprock Canyons State Park (CCSP), Briscoe County, Texas, and base management plans on restoring native prairies to preserve the historic herd of Southern Plains Bison (*Bison bison bison*). The purpose of this study is to provide TPWD with recommendations for antihelminthic treatment of the bison herd. In January 2020 and February 2021, TPWD treated half of the sampled bison (n = 50) with Cydectine (moxidectine) leaving the remaining half (n = 50) untreated. Fecal samples were collected prior to treatment during examination of individuals. Samples were processed for intestinal parasites using a modified McMaster's fecal float protocol. The Baermann technique was added for samples collected in February 2021 to test for the lungworm, *Dictyocaulus*. Difference in parasite load between the sampling dates was calculated. We assessed the effect of treatment and age on parasite load using a generalized linear model for each parasite species. We observed 4 different parasite types: Coccidia, *Moniezia*, *Strongyloides*, and Strongylid-type. No lungworm infection has been detected. We will report the results on differences in parasite load between treated and untreated adult and juvenile bison after one year. The study will continue for the next year and samples will be assessed again at the end of the 2-year study. To improve management, we will provide TPWD with an assessment of effectiveness of antihelminthic treatment by age group.

2:45 pm

17. **Comparison of Endohelminths of the Black Drum (*Pogonias cromis*) and the Red Drum (*Sciaenops ocellatus*) from a Texas Estuarine System**. Hannah McNeese[1], Autumn J. Smith-Herron[2], and Tamara J. Cook[1]. [1]Department of Biological Sciences, Sam Houston State University, Huntsville, Texas; [2]Texas Invasive Species Institute, Sam Houston State University, Huntsville, Texas.

The black drum (*Pogonias cromis*) and the red drum (*Sciaenops ocellatus*) are two closely related fish species that occur throughout the Gulf of Mexico. These species utilize estuarine systems as brooding grounds for their young, which offers protection, and food sources to juveniles. This study sought to understand how endo-parasitic communities of the juvenile and sub-adult individuals of the two drum species compared, and to determine what the effects of host size and habitat salinity were on the parasitic communities in and between fish species. We conducted a helminth survey on black drum (n=59) and red drum (n=61) taken from Sabine Lake in spring and summer 2018. We identified 38 parasite species (23 nematodes, 6 trematodes, 5 acanthocephalans, and 4 cestodes). Significance for the interaction of host size and parasitic intensity was realized, though the model did not adequately explain the relationship. The Jaccard index value was 0.2895, or 28.95% similarity between the communities, and Hutcheson-t did show significant difference in diversity between the two communities. The results did not show the predicted relationships of host size and habitat salinity on the parasite communities overall. This study is still significant as a primary helminth survey from Sabine Lake, and as new host and locality documentations for several parasite species.

3:00 pm

18. **Spring parasite community in Crappie from Lake Nasworthy, San Angelo, TX**. Chatta Russell and Nicholas Negovetich. Biology Department, Angelo State University, San Angelo, Texas.

Lake Nasworthy is a shallow reservoir located just south of San Angelo, TX. This reservoir presents numerous recreational activities including fishing. The purpose of this study is to report the parasite community found within white crappie (*Poximus annularis*) of Lake Nasworthy during the Spring of 2021. All of the crappie caught using rod and reel, which excluded the smallest size class of fish. Upon return to the research lab, crappie were weighed and measured. Full body necropsy of the fish were performed using standard methods. With the exception of gill monogeneans, parasites were and identified. The results of this survey will be reported and compared to a survey of white crappie that were collected during November 2019.

3:15 pm

19. **Parasites in mosquitofish from Sunset Pond, San Angelo, TX**. Kellen Rowe. Biology Department, Angelo State University, San Angelo, Texas.

This study focuses on identifying the parasites in *Gambusia affinis* collected from an urban pond in San Angelo, TX. A total of 39 fish were collected in February and March using hand and seine nets. The fish were then necropsied according to standard procedures. Fish were infected with 7 different parasites including the monogeneans *Salsuginus seculus* and *Gyrodactylus* sp.; metacercariae of *Diplostomulum* sp., *Posthodisplostomum minimum*, and *Clinostomum* sp.; and pleurocercoids of *Proteocephalus* sp. Glochidia were also found on the fins of 15% of the fish. The parasites of *G. affinis* have been studied at this pond for several years. Nearly all of the parasites reported here have been previously observed. The only new report is the glochidia. Parasites that were not found this spring include the larval nematode *Eustrongylides* sp., the larval cestode *Bothriocephalus* sp., the acanthocephalan *Neoechinorhynchus* sp., and a pentastome nymph likely belonging to the genus *Sebekia*.

3:30 pm

20. **Endangered fishes, invasive parasites, and migratory birds: A study in habitat modification to interrupt parasitic life cycles**. Tania Peña and Kyler R. Gideon, Matthew T. Donelon, David G. Huffman. Biology Department, Texas State University, San Marcos, Texas.

The inquisitive Green Heron, *Butorides virescens*, is a major player among the factors that are currently threatening the fountain darter, *Etheostoma fonticola*, an endangered fish endemic to the San Marcos and Comal Springs of central Texas. The bird is host of two invasive heterophyid trematodes from Asia, *Haplorchis pumilio* and *Centrocestus formosanus*, that heavily parasitize the gills, fin-ray insertions and jaw joints of the fish, interfering with respiration, swimming, and eating. As the two parasites simultaneously weaken the darters, they are more easily captured by piscivorous birds. Days after consuming an infected fish, a Green Heron may defecate thousands of parasite eggs. If, at that moment, the tail of the bird is over the water of Landa Lake, which impounds Comal Springs, the most delicate part the parasite life cycle is advanced. An oddity among herons, this little bird rarely gets its feet wet, and forages from structures above or emerging from the water. Thus, the behavior of the bird will be studied on Landa Lake to identify structures that could be modified with the goal of substantially reducing the density of cercariae infective to the fountain darters. After studying the bird's foraging and roosting behaviors from kayaks over the course of a year, I will produce an ArcGIS map of the frequencies of various behaviors displayed at each structure. A prioritized plan will then be developed for the phased modification of problematic over-water structures that the Green Heron favors. This could be particularly valuable during sustained droughts, when cercarial densities are likely to otherwise exceed lethal levels for the darters.

3:45–4:00 Break

4:00–4:45 Session F: Oral Presentations 21–23

Chairpersons
SHEA SERA, Creighton University
JAKE STREHLOW, Creighton University

4:00 pm

21. **Improved Protocols for Monitoring the Status of Invasive Heterophyid Trematodes**. Kyler Gideon. Biology Department, Texas State University, San Marcos, Texas.

Haplorchis pumilio and *Centrocestus formosanus* are heterophyid trematodes that have invaded many freshwater ecosystems across the world due to their ability to infect many different hosts at both the second-intermediate (fishes) and definite host (piscivorous birds) levels. The main factor limiting their further dispersal is the cold-water sensitivity of their principal invasive snail host, *Melanoides tuberculata*. These parasites were introduced into the local San Marcos area springs in the 1990's and are now impacting fish of most native families, including species of concern such as the endangered Fountain Darter. One issue facing the management of this parasite problem is that the agencies responsible for mitigating the impact of invasives have largely ignored the threat of *H. pumilio* despite convincing arguments and scientific reports of its threat. Another issue is that the current protocol for estimating cercarial counts is cumbersome and time consuming, underestimates *H. pumilio* cercarial density, and is not indicative of the level of harm to fish. These issues have contributed to historically inaccurate reports of the problem both parasites are causing for the Fountain Darters. We aim to develop a more accurate and efficient cercariometry device, an improved counting protocol, as well as a mathematical model that will return accurate estimates of harm level to fish. Cercariometry readings will be coordinated with a caged-fish study that will allow us to determine rates at which fish in this area are acquiring parasites relative to cercarial density. A Harm Index will be developed that links ranges of cercariometric readings to the estimated degree of harm darters are likely experiencing. A set of Action Thresholds will be developed based on the Harm Index. Each higher level of Action Threshold will recommend corrective actions designed to bring the Harm Index back down.

4:15 pm

22. **Parasite transmission in a milkweed patch: how are parasites transmitted in insects specializing on milkweed hosts?** Matthew G. Bolek[1], Ryan P. Shannon[1], Jillian T. Detwiler[2], David D. Berman[1], and Kristen A. Baum[1]. [1]Department of Integrative Biology, Oklahoma State University, Stillwater, Oklahoma; [2]Department of Biological Sciences, University of Manitoba, Manitoba.

Milkweeds in the genus *Asclepias* are perennial plants consisting of over a hundred species native to North America and named for their milky sap that contains latex and complex chemicals unpalatable to most animals. Nevertheless, milkweeds serve as host plants for a diverse assemblage of insect herbivores that utilize *Asclepias* species as their primary food source. However, because milkweeds are perennials and only a small portion of the plant is ever consumed by its insect herbivore, parasites of these insect herbivores should face spatial constraints in their transmission from host to host. In this study we examined eleven species of insect specialists on milkweeds from three insect orders (Hemiptera, Coleoptera and Lepidoptera) for their parasites and evaluated the transmission strategies of those parasites. The insects included oleander aphids, *Aphis nerii*, large milkweed bugs, *Oncopeltus fasciatus*, small milkweed bugs, *Lygaeus kalmia*, swamp milkweed beetles, *Labidomera clivicollis*, milkweed longhorn beetles, *Tetraopes mandibularis* and *T. texana*, milkweed stem weevils, *Rhyssomatus lineaticollis*, unexpected cycnia moths, *Cycnia inopinatus*, milkweed tussock moths, *Euchaetes egle*, queen butterflies, *Danaus gilippus*, and monarch butterflies, *D. plexippus*. All parasites were identified based on morphology and/or sequence data. Of the 11 species of insects sampled, we found that small and large milkweed bugs shared a generalist kinetoplastid (*Leptomonas wallacei*). In contrast, swamp milkweed beetles, and monarchs and queen butterflies were infected with specialist parasites including a podapolipid mite (*Chrysomelobia labidomerae*), and two species of neogregarines (*Ophryocystis elektroscirrha* and *Ophryocystis* sp. n.), respectively. However, the transmission strategies of the four species of parasites found during this study all shared either maternal transmission, where parasite cyst stages are acquired by newly hatched insects when they ingest eggshell remains after hatching (kinetoplastid and neogregarines) and/or sexual transmission, where infective stages of parasites are transmitted between the opposite sexes during copulation (mite and neogregarines). Our study suggests that the spatial constraints of living on a milkweed plant have selected for similar transmission strategies in unrelated species of parasites infecting unrelated species of insect hosts. More broadly our work indicates that parasite transmission strategies can be predicted based on understanding the ecological avenues and constraints parasites life cycles and their hosts operate under.

4:30 pm

23. **Morpho-histopathological alterations induced by *Neascus* sp. (Diplostomidae Poirier, 1886) larvae in respiratory and hepatic tissues of *Xenentodon cancila* (Hamilton, 1822)**. Pinky Kaur and Rekha Shrivastav. Department of Zoology and Applied Aquaculture, Barkatullah University, M.P. India, Department of Zoology, MVM, Bhopal, India.

The present study revealed the morpho-histopathological investigation in respiratory and hepatic tissues of *Xenentodon cancila* infected by *Neascus* sp. metacercaria. Encysted forms were round, opaque white, measured 120 – 1140 µm in diameter, and with a prevalence of 12.9%. Metacercaria primarily found attached to the primary and secondary gill lamellae and the cartilage. Pathogenicity of parasites revealed the proliferation of branchial tips, shortening and fusion of secondary gill lamellae, desquamation of primary and secondary gill lamellar epithelium, the uplifting of the respiratory epithelial wall, and damaged pillar cells. Whereas, infected liver morphologically showed a porous and rough appearance because of the presence of encysted metacercariae within the parenchyma tissue. Histological changes indicated loosening in hepatic tissue, irregular lobular arrangement, and necrosis was seen. Hepatocytes were mostly indistinguishable, appeared enucleated with a round in contour instead of hexagonal shape. The infected liver also exhibited severe fatty vacuolization in hepatocytes.

4:45–5:00 pm Closing Remarks & Adjournment

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2010	John Hnida	Matthew G. Bolek
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2012	Alan M. Fedynich	Charles K. Blend
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2014	Ben Hanelt	Sara V. Brant
2015	Sara V. Brant	Megan Wise de Valdez
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2017	Nicholas Negovetich	Michael A. Barger
2018	Michael A. Barger	Kristin K. Herrmann
2019	Kristin K. Herrmann	Heather A. Stigge
*2020–2021	Heather A. Stigge	Joanna J. Cielocha

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