NC Chapter of The Wildlife Society
Annual Meeting

“Wildlife Health and Diseases”

Trinity Center
Pine Knoll Shores, NC
February 15-17, 2022

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Annual Meeting Agenda

Tuesday, February 15th

	Concurrent Field Workshops
12 – 4 PM	**Option A**: Necropsy/Wildlife Disease Investigation – Southeastern Cooperative Wildlife Disease Study
1 – 4 PM	**Option B**: Chemical Immobilization Demo – Seth Brown, USDA-WS, & Colleen Olfenbuttel and Justin McVey, NCWRC
4:30 PM	Registration (open until 5:45 PM)
6:00 PM	Dinner
7:00 PM	Social/Poster Session/Jam Session Icebreaker Bingo, Official Poster Session 7:00 – 8:30 PM

Wednesday, February 16th

6:30 AM	Optional: Coastal Bird Walk – Jamies Sasser, NCWRC, and Dr. Chris Moorman, NCSU
7:00 AM	Registration (open until 8:45 AM)
8:00 AM	Breakfast
8:45 AM	Door Prizes
8:50 AM	Welcome
9:00 AM	*PLENARY: Emerging Wildlife Diseases–The BIG Picture* – Dr. David Stallknecht, SCWDS
9:45 AM	*The Expanding Range of Chronic Wasting Disease and Implications for its Surveillance in North Carolina* – Moriah Boggess, NCWRC
10:15 AM	Break (registration open)
10:25 AM	Door Prizes
10:30 AM	*Hopping into RHDV2: NC Prepares* – Andrea Shipley, NCWRC
11:00 AM	*Discovering the Distribution of Ticks and Tick-borne Illness in North Carolina* – Dr. Alexis Barbarin, NCDHHS DPH
11:30 AM	*White-Nose Syndrome and the Mass Mortality of Bats in North America* – Olivia Munzer, NCWRC
12:00 PM	Lunch
12:55 PM	Door Prizes
1:00 PM	Announcements/Updates-Award Presentations

1:30 PM	*Ecotoxicology in Non-traditional Wildlife Species: Contaminant Residues in Raptor Tissue Samples and Improving our Understanding of Ecotoxicology of Pesticides in Salamanders* – Dr. Scott Weir, Queens University
2:00 PM	*Rodenticides in Bobcats* – Jim Jordan, Kiawah Island
2:30 PM	Break (registration open)
2:40 PM	Door Prizes
2:45 PM	*Echinococcus and Mange: Current Research from SCWDS* – Dr. Chris Cleveland and Dr. Michael Yabsley, SCWDS
3:15 PM	*Baylisascaris Surveillance in Raccoons in North Carolina* – Colleen Olfenbuttel, NCWRC, and Kelly Douglass, USDA-WS
3:45 PM	Break (registration open)
3:55 PM	Door Prizes
4:00 PM	*Listeria monocytogenes at the human–wildlife interface: black bears (Ursus americanus) as potential vehicles for Listeria* – Dr. Chris Deperno, NCSU
4:30 PM	*Feral Swine Disease Surveillance and Management in North Carolina* – Josh Biesecker, USDA-WS
5:00 PM	Free Time Corvid Club Social (5-6 PM) – Corvid Club Members only
6:00 PM	Dinner
7:00 PM	Social/Auctions/Raffles/Jam Session

Thursday, February 17th

7:00 AM	Registration (open until 8:45 AM)
8:00 AM	Breakfast
8:55 AM	Door Prizes
9:00 AM	NCTWS Business Meeting (detailed agenda on page 36)
10:00 AM	*Avian Influenza* – Dr. Michael Martin, NCDA&CS
10:30 AM	*Sociodemographic and Regional Determinants of Rabies Submission Bias in North Carolina* – Dr. Rachael Urbanek, UNCW
11:00 AM	Break
11:10 AM	Door Prizes
11:15 AM	*Snake Fungal Disease, Chytrid Fungus, Ranavirus, and More* – Lori Williams, NCWRC

11:45 AM	*Canine Distemper Virus Outbreak in a Population of Eastern Spotted Skunks* – Dr. David Jachowski, Clemson University
12:15 PM	Closing Remarks/Adjourn
12:30 PM	Lunch
	2022-2023 Executive Board meeting (12:45 – 1:30 PM)

Field Trips/Workshops

Necropsy/Wildlife Disease Investigation

DR. CHRISTOPHER CLEVELAND, Assistant Professor, Department of Population Health, Southeastern Cooperative Wildlife Disease Study, ccleve@uga.edu

DR. ELLEN HAYNES, Post-doctoral Research Associate, Southeastern Cooperative Wildlife Disease Study, eh71937@uga.edu

DR. NICOLE NEMETH, Associate Professor, Department of Pathology, Southeastern Cooperative Wildlife Disease Study, nmnemeth@uga.edu

DR. MARK RUDER, Assistant Professor, Department of Population Health, Southeastern Cooperative Wildlife Disease Study, mgruder@uga.edu

DR. DAVID STALLKNECHT, Adjunct Faculty, Department of Infectious Diseases, Department of Population Health, Director of the Southeastern Cooperative Wildlife Disease Study, dstall@uga.edu

DR. MICHAEL YABSLEY, Daniel B. Warnell Professor in Forestry and Natural Resources, UGA, and Southeastern Cooperative Wildlife Disease Study, myabsley@uga.edu

Get hands-on training conducting a necropsy with professionals from the Southeastern Cooperative Wildlife Disease Study (SCWDS). Drs. Chris Cleveland, Ellen Haynes, Nicole Nemeth, Mark Ruder, Dave Stallknecht and Michael Yabsley will give a short presentation in the Morgan Beach House before offering a necropsy demonstration. Immediately following, participants will get to practice disease investigation on different animals including vultures, beavers, raccoons, and foxes. SCWDS personnel will also give instructions on properly packaging biological samples in preparation for shipping.

Bios: Dr. Christopher Cleveland is an Assistant Professor with the Southeastern Cooperative Wildlife Disease Study at the University of Georgia. His research focuses on wildlife diseases and molecular parasitology with particular foci on parasite life-cycles, transmission dynamics, and disease management and surveillance in a One Health framework. This work also entails understanding the effects of anthropogenically driven climate and landscape change has on the epidemiology of wildlife diseases and associated vectors. Current projects include *Echinococcus* species surveillance, Guinea worm eradication, Snake fungal disease, and helminths of wild canids. This work involves field collections and laboratory methods, including classical parasitological skills, modern molecular approaches and wildlife population techniques. He also teaches a variety of

undergraduate and graduate level courses on vectors and vector borne diseases, wildlife comparative parasitology, and current problems in wildlife population health.

Dr. Ellen Haynes is a wildlife veterinarian and epidemiologist with broad interests in infectious diseases of free-ranging wildlife. She has a DVM from Cornell University and a PhD from the University of Illinois. Her PhD work focused on the epidemiology and treatment of ophidiomycosis, as well as genomic variation of the fungus *Ophidiomyces ophidiicola*. Dr. Haynes joined SCWDS in June 2021 and is currently a Post-doctoral research associate in the Cleveland Lab. She is working on projects investigating treatment and transmission of Guinea worm in domestic dogs and multi-pathogen infections in snakes.

Dr. Nicole Nemeth is a faculty member and wildlife pathologist in the Pathology Department at the University of Georgia (UGA) and Director of the Southeastern Cooperative Wildlife Disease Study Research and Diagnostic Service. Prior to joining the faculty at UGA she was a faculty member at the Ontario Veterinary College, University of Guelph where she worked closely with the Canadian Wildlife Health Cooperative. Her DVM and PhD are from Colorado State University, and she did an anatomic pathology residency at UGA. She has worked on a variety of wildlife diseases over the past 20 years, from West Nile virus-associated disease, to lymphoproliferative disease and snake fungal disease (ophidiomycosis). She also has worked at the US Centers for Disease Control and Prevention and US Dept. of Agriculture-National Wildlife Research Center. Her research interests include infectious diseases of wildlife, effects on environmental contaminants on wildlife, and wild bird disease and conservation.

Dr. Mark Ruder is an Assistant Professor at the Southeastern Cooperative Wildlife Disease Study (College of Veterinary Medicine, University of Georgia). Founded in 1957, SCWDS is a regional wildlife health cooperative research unit comprised of 17 state wildlife management agencies and federal agency partners. The mission of SCWDS is centered on research, service and instruction related to understanding wildlife diseases and their impact on wildlife populations, as well as the role wildlife play in diseases of domestic animals and humans. Mark is broadly engaged in wildlife health research, surveillance, and mortality investigations and manages core service, research, and training activities for the state and federal wildlife agencies that are members of SCWDS.

Dr. David Stallknecht is a professor in the Department of Population Health, College of Veterinary Medicine, University of Georgia (UGA), and is Director of the Southeastern Cooperative Wildlife Disease Study (SCWDS); he has been with SCWDS for 40 years. Dr. Stallknecht received his PhD in epidemiology and community health from Louisiana State University and his MS in wildlife biology from UGA. His research interests currently focus on the epidemiology of two diseases that directly affect wildlife health or indirectly affect domestic animal or public health, hemorrhagic disease in deer and avian influenza in ducks and shorebirds.

Dr. Michael J. Yabsley, the Daniel B Warnell Professor at the University of Georgia (UGA), has a spilt position between the Warnell School of Forestry and Natural Resources and the Southeastern Cooperative Wildlife Disease Study (SCWDS). He has a BS (Biological Sciences and Wildlife Sciences) and an MS in zoology (Parasitology) from Clemson University and a PhD in Infectious Diseases from UGA. Dr. Yabsley teaches wildlife disease and parasitology courses in the undergraduate, veterinary, and graduate curriculums and he mentors high school, undergraduate, veterinary, MS, and PhD students. His One Health interdisciplinary research program addresses applied and theoretical questions on the epidemiology of wildlife diseases with an emphasis on

pathogens that are zoonotic or important to the health of domestic animals and agriculturally important species. Research interests in recent years include native and invasive ticks and tick-borne pathogens, guinea worm, raccoon roundworm, and avian parasites. This research has led to >275 peer-reviewed authored or co-authored publications.

Chemical Immobilization Demo

SETH BROWN, Rabies Biologist, USDA APHIS Wildlife Services North Carolina, christopher.s.brown@usda.gov

JUSTIN McVEY, CWB®, District Wildlife Biologist, NC Wildlife Resources Commission, justin.mcvey@ncwildlife.org

COLLEEN OLFENBUTTEL, CWB®, Black Bear and Furbearer Biologist, NC Wildlife Resources Commission, colleen.olfenbuttel@ncwildlife.org

Join Seth Brown, USDA-WS, Justin McVey, CWB®, NCWRC and Colleen Olfenbuttel, CWB®, NCWRC for a two-part chemical immobilization workshop. The first half of the workshop will begin with Seth Brown who will discuss the USDA-WS raccoon oral rabies vaccine program while anesthetizing three raccoons using different chemicals. For the second half of the workshop, Colleen Olfenbuttel and Justin McVey will demonstrate the use of chemical immobilization equipment then give participants the opportunity to practice with it.

Bios: Seth Brown has been a Rabies Biologist with USDA Wildlife Services for the past four years. He covers 17 counties in western North Carolina. His primary duties are to conduct Enhanced Rabies Surveillance throughout those 17 counties and assist local Health Departments and Animal Control facilities with monitoring and testing efforts. He also assists with baiting efforts via fixed wing, rotary wing, and hand baiting targeting rabies vector species in the primary focus area. Prior to working with Wildlife Services, Seth served four years in the United States Marine Corps. Then he attended Haywood Community College where he received an associate degree in Wildlife and Fisheries Management. Then he went on to The University of Tennessee and acquired a bachelor's degree in Wildlife and Fisheries Science.

Since 2007, Colleen Olfenbuttel has been the Black Bear and Furbearer Biologist for the NC Wildlife Resources Commission. She received her bachelor's degree in wildlife biology from Ohio University ('97) and her master's in wildlife management from Virginia Tech ('05). Colleen is a Certified Wildlife Biologist® and has over 25 years of experience in the wildlife profession. She has co-authored over 30 peer-reviewed journal publications and was the lead author for the state's Black Bear Management Plan and the Coyote Management Plan. Currently, she serves on several regional and national species-focused committees and has on-going research projects with bears and furbearers. She is the past-president of NCTWS, chair-elect of TWS's Wildlife Damage Management Working Group and a TWS Fellow.

Justin McVey is the mountain regional district wildlife biologist for the North Carolina Wildlife Resources Commission. Justin has a Bachelor of Science degree in zoology from North Carolina State University. He also obtained his Master of Science in wildlife and conservation biology from North Carolina State University studying the food habits of coyotes and red wolves in Eastern North Carolina. Justin has been employed by the North Carolina Wildlife Resources Commission since 2005, holding the positions of captive cervid biologist, wildlife technician, permits biologist, and the

recent position of district wildlife biologist. This district includes the western 12 counties of North Carolina. The duties of the district biologist include providing technical guidance to landowners regarding wildlife, technical assistance regarding nuisance wildlife, development and review of hunting and trapping regulations, and monitoring of wildlife populations including the management of North Carolina's elk herd on private and public land.

Invited Speakers

PLENARY: Emerging Wildlife Diseases—The Big Picture

DR. DAVID STALLKNECHT, Adjunct Faculty, Department of Infectious Diseases, Department of Population Health, Director of the Southeastern Cooperative Wildlife Disease Study, dstall@uga.edu

Disease emergence is all about taking advantage of opportunity, and unfortunately such opportunities are usually provided by our actions. The opportunities that an infectious agent requires to emerge are relatively simple. The most basic is a transmission link. Once transmission is successful, opportunities for that pathogen to increase host species range, become endemic, increase geographic distribution, become more transmissible, and evade immune responses can follow. Using the emergence of SARS-CoV-2 as an example, it is thought that the initial transmission opportunity occurred through abnormal contact between wildlife species in a wildlife market setting and later to humans through contact with the recombinant coronavirus generated under wildlife marketing conditions. Once transmissible between humans, the virus spread globally and mutated to increase its transmissibility and better evade the host immune response; it is now or shortly will be regarded as endemic. To make matters worse, additional transmission opportunities followed that connected SARS-CoV-2 with additional hosts, such as domestic cats, dogs, hamsters, felids in zoos, farmed mink, and most recently white-tailed deer. All infectious wildlife diseases follow many of these same paths all of which are created by human behaviors and actions and conditions that: increase contact between species that are not normally connected; abnormally increasing population densities; modify the environment to increase vector or wildlife populations, alter the normal range of domestic animals and wildlife; and modify wildlife behaviors that enhance transmission. The emergence of new wildlife diseases are not new but will likely increase as a result of our changing wildlife populations, environments, and the way we directly or indirectly interact with wildlife species.

Bio: See bio on Necropsy/Wildlife Disease Investigation workshop page 8.

The Expanding Range of Chronic Wasting Disease and Implications for its Surveillance in North Carolina

MORIAH BOGGESS, Deer Biologist, NC Wildlife Resources Commission,
moriah.boggess@ncwildlife.org

Chronic Wasting Disease (CWD) is the most serious threat to white-tailed deer populations nationally and locally. It is an always fatal neurological disease caused by a misfolded protein (prion) that replicates in the body of infected animals until eventually debilitating the animal, resulting in wasting and death. The prion that causes CWD is long lived in the environment and cannot be readily destroyed. The disease has been detected in the wild herds of 27 US states, three Canadian Provinces, Finland, Norway, and Sweden. In these jurisdictions surveillance and management efforts continue to detect a spread and increase in prevalence of this disease within the effected deer populations. Concurrently, detections of the disease in new states and management areas provide evidence that the disease is spreading across the country. In May 2021, a white-tailed buck in Montgomery County Virginia tested positive for CWD just 33 miles north of the North Carolina border. This detection has prompted revisions to both the surveillance and response plans of the North Carolina Wildlife Resources Commission (NCWRC). A boost in NCWRC surveillance and educational efforts have made the 2021 fall surveillance season the most successful on record and the samples collected are providing valuable information to the agency about the health of the deer population.

Bio: Moriah Boggess is a NC native from the foothills of Wilkes Co. Moriah earned a degree in Fisheries, Wildlife, and Conservation Biology at North Carolina State University. He went on to earn his master's at Mississippi State University where he studied the effects of white-tailed deer on oak regeneration dynamics. His personal interests in deer ecology, forest dynamics, and plant communities are represented in his professional work and hobbies. Beyond his academic experience Moriah has worked for the Indiana Department of Natural Resources as the state deer biologist and now serves in this same capacity for the North Carolina Wildlife Resources Commission

Hopping into RHDV2: NC Prepares

ANDREA SHIPLEY, Mammologist, NC Wildlife Resources Commission,
andrea.shipley@ncwildlife.org

Rabbit Hemorrhagic Disease Variant 2 (RHDV2) has the capability to cause significant mortality in rabbit, hare and related Lagomorph species, as had been seen previously in Europe, Australia, and New Zealand. A type of Calcivirus, RHDV2 is highly contagious and can be carried through a myriad of vectors. In 2020, an outbreak of RHDV2 was found in the southwestern US and has since spread throughout the west into Mexico and has been found in domestic rabbits in the east. From the first outbreak in 2020, NC Wildlife Resources Commission has been in preparation for the virus' arrival to NC. So, what all are we doing? We'll cover that and more in this presentation.

Bio: Andrea Shipley is a mammalogist with the NC Wildlife Resources Commission where she oversees non-game mammals, small game mammals, and red wolves for the state

Discovering the Distribution of Ticks and Tick-borne Illness in North Carolina

DR. ALEXIS BARBARIN, Public Health Entomologist, Division of Public Health, Communicable Disease Branch, North Carolina Department of Health and Human Services, alexis.barbarin@dhhs.nc.gov

Vector-borne diseases (VBD) represent a historical and evolving threat to the residents of North Carolina. The southern expansion of Lyme disease from the northeast into southern Virginia, Tennessee and North Carolina has generated renewed interest in understanding the phenology and distribution of *Ixodes scapularis* ticks in the southern states. The risk of human infection with VBD and means of prevention are dependent on the understanding of the natural nidality of transmissible diseases. Due to limited entomological surveillance in previous years, the state is unclear where, geographically, traditional tick vector species are located. To gather this information the Division of Public Health has developed a series of collaborations with the Centers for Disease Control and Prevention (CDC) in Fort Collins, university partners, the State Laboratory of Public Health, the North Carolina Department of Agriculture and Consumer Services (NCDA&CS), the United States Department of Agriculture (USDA), and veterinarians to understanding of the ecology and distribution of tick vectors and tick-borne pathogens. Results indicate that *Ixodes* ticks are present in the northwest region of North Carolina and do harbor *Borrelia*. Additionally, partnerships have assisted in determining the presence of *Haemaphysalis longicornis* ticks in 21 North Carolina counties. This session will discuss the distribution of tick-borne disease vectors, *Borrelia* infection rates in ticks, and updates in tick-borne disease incidence rates in the residents of North Carolina.

Bio: Dr. Alexis M. Barbarin is a Public Health Entomologist at the North Carolina Division of Public Health (NCDPH). Dr. Barbarin specializes in vector-borne diseases and coordinates human disease and tick surveillance for Rocky Mountain spotted fever, Lyme disease, ehrlichiosis and anaplasmosis and their tick vectors. She is a formally trained entomologist, specializing in tick identification, molecular ecology, and pesticide efficacy. As the public health entomologist at the NCDPH, she serves as the director of the North Carolina Veterinary Tick Identification Program, where she has identified the Asian Longhorned Tick in several counties. She is passionate about public education, and has relaunched the *Fight the Bite* campaign, which encourages North Carolinians to protect themselves from vector-borne diseases by preventing tick and mosquito bites. Dr. Barbarin earned a B.S. in biology from Xavier University of Louisiana (2006), and a MEd in Agricultural & Extension Education (2009) and PhD in Entomology (2012) from Penn State.

White-Nose Syndrome and the Mass Mortality of Bats in North America

OLIVIA MUNZER, Western Piedmont Habitat Conservation Coordinator, NC Wildlife Resources Commission, olivia.munzer@ncwildlife.org

White-nose syndrome (WNS) is a disease that has killed over 6 million bats since 2006. WNS is caused by a newly discovered fungus, *Pseudogymnoascus destructans* (Pd), that grows on the muzzles, ears, and wing membranes of bats hibernating in caves and mines. As the fungus colonizes on the bats, the bats arouse from hibernation, causing the bats to deplete their fat storage and they eventually starve. As WNS continues to spread rapidly across the US, several bat species face extinctions at a local and regional level. In North Carolina, WNS was first detected in the winter of 2010-2011. Since then, bat populations in the mountains have declined over 90 percent compared to their pre-WNS counts. But despite the devastation to bat populations, there is hope. Bat activity during the winter in the Coastal Plain and Piedmont seems to decrease the vulnerability of bats to WNS and may provide a refugium for species highly susceptible to WNS, such as northern long-eared bat and tricolored bat. There is also ongoing research focused on developing strategies to decrease bat mortality from WNS.

Bio: Olivia Munzer has a BS in Zoology from Western Washington University and a MS in Ecology and Organismal Biology from Eastern Michigan University. Her thesis was on the roosting and dietary ecology of the evening bat at the northern edge of their range. She has worked over 20 years as a natural resource biologist throughout the US, including conducting hibernacula, acoustic, and mist-net surveys for bats. For the last five years, she has served as the Western Piedmont Habitat Conservation Coordinator for the NC Wildlife Resources Commission. At NCWRC, she provides technical guidance; reviews project for their potential impact on terrestrial and aquatic resources; conducts species surveys; and collaborates on conservation projects. She is the co-chair for the NC Bat Working Group.

Ecotoxicology in Non-traditional Wildlife Species: Contaminant Residues in Raptor Tissue Samples and Improving our Understanding of Ecotoxicology of Pesticides in Salamanders

DR. SCOTT WEIR, Associate Professor, Queens University of Charlotte,
weirs@queens.edu

The field of ecotoxicology tends to focus on standard model organisms required by federal regulations such as TSCA and FIFRA. Working outside these standard taxonomic groups is often challenging, especially when an important focal species is not well represented by the model organisms. In these cases, managers must work outside the box with a great deal of uncertainty when making management decisions. Here I present two projects within this context. The first is reporting on recent efforts to quantify rodenticides and mercury in raptor livers. Raptor carcasses were acquired from the Carolina Raptor Center and necropsies were performed to remove target tissues which were then analyzed for contaminants using standard instrumental analysis. In my other research project, I am interested in solving two issues at once. First, I want to develop standardized toxicity methods that allow future researchers to more easily perform toxicity tests on non-traditional species. Second, by building up a database of toxicity estimates for a non-traditional species, the goal is to determine whether robust predictive relationships can be built between the sensitivity of non-traditional species and more traditional species tested under FIFRA. I performed dermal toxicity tests on metamorphic spotted salamanders for 4 pesticides and compare results with standard mammalian data. While data are preliminary, it suggests that mammalian tests may not be protective of terrestrial salamanders in all cases. Results from these two experiments can hopefully be used to guide efforts to prevent non-target effects of chemical contamination on wildlife species.

Bio: Scott Weir has been working in ecotoxicology and risk assessment for 15 years. He is interested in working on species not traditionally covered by the ecological risk assessment process with a focus on amphibians and reptiles. Scott prefers to work on projects that build towards useful tools in the risk assessment process, usually in the form of mathematical models or predictive relationships. Scott recently begun working with raptor tissues due to a collaboration with the Carolina Raptor Center north of Charlotte. Scott received his BS in Life Sciences from Arizona State University – West Campus in 2005, my MS in Zoology from Southern Illinois University Carbondale in 2009, and his PhD in Environmental Toxicology from Texas Tech University in 2014. Scott has worked at Queens University of Charlotte since Fall 2015. In the precious free time Scott has, he enjoys hiking and running throughout the mountains of western NC.

Rodenticides in Bobcats

JIM JORDAN, Wildlife Biologist, Town of Kiawah Island, jjordan@kiawahisland.org

In 2007, The Town of Kiawah Island, in partnership with the Kiawah Conservancy, initiated a Bobcat GPS study. Bobcats have been captured and fitted with GPS collars annually since 2007 making this the longest, continuous GPS study on bobcats in the world. As of today, biologists have collared a total of 97 bobcats and obtained more than 180,000 individual GPS locations. Data from this study allows biologists to determine detailed habitat use patterns and to identify habitat areas that are of critical importance to bobcats. Beginning in 2017, Town Biologists started seeing an increase in bobcat deaths on the island and a subsequent decrease in bobcat numbers. Since August 2019, seven bobcats have died due to second-generation anticoagulant (SGA) toxicity or exposure. Since February 2020, biologists have been collecting liver samples from a variety of species and have documented a 70% overall exposure rate to SGAs on the island. The Town has launched a public awareness campaign to reduce the use of SGAs on Kiawah and early results are promising. In addition, a 4-year PhD study, in partnership with Clemson University, was launched this month to gather additional data on this issue.

Bio: Jim has served as Wildlife Biologist for the Town of Kiawah Island since 2000. He is from Columbia, SC and received a Bachelor's degree in Biology from Furman University and a Master of Science Degree in Wildlife Ecology and Management from the University of Georgia. Jim's work at Kiawah involves nuisance wildlife management, invasive plant control, beach management, wildlife population surveys, community outreach, and wildlife research. He has conducted and/or coordinated a variety of research projects on Kiawah Island, focusing primarily on white-tailed deer ecology and fawn survival, bobcat ecology and habitat use, songbird migration and banding, and most recently, alligator physiology and behavior.

Echinococcus and Mange: Current Research from SCWDS

DR. MICHAEL YABSLEY, Daniel B. Warnell Professor in Forestry and Natural Resources, UGA, and Southeastern Cooperative Wildlife Disease Study, myabsley@uga.edu

DR. CHRISTOPHER CLEVELAND, Assistant Professor, Department of Poplation Health, Southeastern Cooperative Wildlife Disease Study, ccleve@uga.edu

Echinococcus spp. can cause disease in wildlife, domestic/agriculture animals and humans. Sarcoptic mange, caused by *Sarcoptes scabiei*, is a concern for wild carnivores. *Echinococcus* and *Sarcoptes* are quintessential One Health pathogens with intersections between wild/domestic mammals and humans. In North America, *Echinococcus multilocularis* (*E.m.*) and *E. canadensis* (*E.c.*) primarily use red foxes, gray foxes, coyotes, and wolves as definitive hosts and rodents and cervids, respectively, as intermediate hosts. Although historically absent in the eastern US, recent reports from dogs, a human, and translocated elk highlight the need for surveillance. During 2019-2020, 2 of 307 wild canids, both coyotes, in Pennsylvania were positive for *E.m.* and *E.c.*. These data support the need for additional research and surveillance. Our mange studies have focused on understanding disease ecology. We have documented the geographic extent and number of cases of sarcoptic mange in black bears, examined if exposure to one of several pathogens of bears was a potential risk factor for clinical mange, used a serological approach to determine the extent of exposure in bears without clinical disease to gain a better appreciation for which populations of bears are exposed to mites, and examined the ability of mites to survive off the host and used these data to speculate on the role of indirect transmission of mites. In addition to the utility of these studies in advancing our understanding of sarcoptic mange in wildlife, many of these studies can also be used to drive management decisions or lay the groundwork for future research of this disease in bears.

Bios: Michael Yabsley – See bio on Necropsy/Disease Investigation workshop page 8.

Christopher Cleveland – See bio on Necropsy/Disease Investigation workshop page 7.

Baylisascaris Surveillance in Raccoons in North Carolina

COLLEEN OLFENBUTTEL, CWB®, Black Bear and Furbearer Biologist, NC Wildlife Resources Commission, colleen.olfenbuttel@ncwildlife.org

KELLY DOUGLASS, CWB®, Wildlife Disease Biologist, USDA APHIS Wildlife Services North Carolina, kelly.douglass@usda.gov

In early 2021, the North Carolina Wildlife Resources Commission partnered with USDA APHIS Wildlife Services (WS) to initiate a statewide survey to determine the prevalence of raccoon roundworm (*Baylisascaris procyonis*). This survey was a follow up on an earlier survey conducted from 2010 to 2011 that detected raccoon roundworm in five western counties bordering Tennessee (12% of raccoons sampled). The authors of this study recommended additional surveillance to accurately determine distribution of raccoon roundworm. It is currently unknown what impacts this nematode has on humans and mammals in North Carolina, and specifically, the Allegheny woodrat (*Neotoma magister*). Studies outside of North Carolina have documented woodrat mortality associated with raccoon roundworm and the 2015 NC Wildlife Action Plan recognized raccoon roundworm as a possible threat to woodrat populations. Raccoons are being sampled opportunistically as part of various WS projects across the state and from January 2021 through November 2021, 157 raccoons were sampled. Roundworm was detected in 8 raccoons from 6 western counties, of which 5 counties were new detections. Our goal is to opportunistically sample 20-30 raccoons per county in North Carolina, with a focus on the Mountain Furbearer Management Unit. In addition, we are working with a detection dog team to train a dog to detect raccoon feces, which will be used to search for raccoon feces around active woodrat colony sites. Results of this survey will determine how far raccoon roundworm has expanded into North Carolina and inform both agencies on the potential impacts on both human and wildlife health.

Bio: Colleen Olfenbuttel – See bio on Chemical Immobilization Demo workshop page 10.

Kelly Douglass currently serves as the Wildlife Disease Biologist with USDA APHIS Wildlife Services in North Carolina and is responsible for planning, coordinating, and implementing wildlife disease surveillance and monitoring programs statewide, including emergency preparedness and response. She is a TWS Fellow, Certified Wildlife Biologist, Certified Environmental Educator, and an alumnus of the TWS Leadership Institute. She holds a BS degree in Fisheries and Wildlife Sciences from NC State University in 2002, and a MS degree in Fisheries, Wildlife, and Conservation Biology from NCSU in 2011.

Listeria monocytogenes at the human–wildlife interface: black bears (*Ursus americanus*) as potential vehicles for *Listeria*

DR. CHRISTOPHER DEPERNO, CWB®, Professor and Wildlife Extension Specialsit, NC State University, chris_deperno@ncsu.edu

Listeria monocytogenes is the causative agent of the foodborne illness listeriosis, which can result in severe symptoms and death in susceptible humans and other animals. *L. monocytogenes* is ubiquitous in the environment and isolates from food and food processing, and clinical sources have been extensively characterized. However, limited information is available on *L. monocytogenes* from wildlife, especially from urban or suburban settings. As urban and suburban areas are expanding worldwide, humans are increasingly encroaching into wildlife habitats, enhancing the frequency of human–wildlife contacts and associated pathogen transfer events. We investigated the prevalence and characteristics of *L. monocytogenes* in 231 wild black bear capture events between 2014 and 2017 in urban and suburban sites in North Carolina, Georgia, Virginia and United States, with samples derived from 183 different bears. Of the 231 captures, 105 (45%) yielded *L. monocytogenes* either alone or together with other Listeria. Analysis of 501 samples, primarily faeces, rectal and nasal swabs for Listeria spp., yielded 777 isolates, of which 537 (70%) were *L. monocytogenes*. Most *L. monocytogenes* isolates exhibited serotypes commonly associated with human disease: serotype 1/2a or 3a (57%), followed by the serotype 4b complex (33%). Interestingly, approximately 50% of the serotype 4b isolates had the IVb-v1 profile, associated with emerging clones of *L. monocytogenes*. Thus, black bears may serve as novel vehicles for *L. monocytogenes*, including potentially emerging clones. Our results have significant public health implications as they suggest the ursine host may contract *L. monocytogenes* of clinically relevant lineages over the diverse listerial populations in the environment. These results elucidate the ecology of *L. monocytogenes* and highlight the public health significance of the human–wildlife interface.

Bio: Christopher S. DePerno earned a Bachelor of Science from Central Michigan University (1990), a Master of Science from Purdue University (1994), and a doctorate from South Dakota State University (1998). From 1999-2004, he worked as the white-tailed deer senior research scientist for the Minnesota Department of Natural Resources. For 18 years, he has been a Professor and Wildlife Extension Specialist at North Carolina State University. His research interests include population ecology, management, and habitat selection of a variety of species, animal damage management, wildlife and zoonotic diseases, and public education. In 2002, he became a 'Certified Wildlife Biologist' via The Wildlife Society and has been the Past-President of the North Carolina Chapter of The Wildlife Society and the Great Plains Natural Science Society. He has over 160 peer-reviewed publications and has supervised 39 graduate student research projects.

Feral Swine Disease Surveillance and Management in North Carolina

JOSH BIESECKER, Feral Swine Biologist, USDA APHIS Wildlife Services North Carolina, joshua.l.biesecker@usda.gov

The USDA APHIS National Feral Swine Damage Management Program partners with the National Wildlife Disease Program, Veterinary Services Swine Health staff, and the Center for Epidemiology and Animal Health to identify national diseases of concern in feral swine. The current feral swine disease surveillance program was modified substantially in 2021 and now is predicated as a foreign animal disease surveillance system, particularly focused on classical swine fever, African swine fever, and foot-and-mouth disease. Additionally, this framework integrates monitoring of domestic diseases of concern such as pseudorabies and swine brucellosis. Historically, this surveillance program has also included surveillance for a variety of other feral swine diseases, such as toxoplasmosis, trichonellosis, leptospirosis, and more. This presentation will cover the current and historical feral swine disease sampling efforts conducted by USDA in North Carolina, in addition to a cursory overview of some feral swine diseases of concern.

Bio: Josh Biesecker currently serves as a Feral Swine Biologist with USDA APHIS Wildlife Services in North Carolina and is responsible for coordinating feral swine disease surveillance and management activities in the Northeastern District. He holds a bachelor's degree in Fisheries and Wildlife Sciences from NC State University in 2003, and started with USDA shortly after graduating.

Avian Influenza

DR. MICHAEL MARTIN, NC State Veterinarian and Director of the Veterinary Division, NCDA&CS, Michael.Martin@ncagr.gov

This presentation will include a brief overview of avian influenza as a population disease. A recent history of avian influenza regulations and outbreaks will be presented. The 2020 NC/SC H7N3 Outbreak will be discussed as well as the 2022 H5N1 Eurasian HPAI in wild waterfowl. Interactions between state and federal, agriculture and wildlife regulatory officials will be discussed. Emphasis will be on disease transmission, outbreak response, state and national planning, surveillance, messaging and impact on NC state agriculture.

Bio: Dr. Martin has been the NC State Veterinarian since August 2021 after serving as the Director of Poultry Health Programs at the North Carolina Department of Agriculture and Consumer Services for four years. Previously, he was Associate Professor at the North Carolina State University, College of Veterinary Medicine where he was the head of poultry clinical activities and residency program. He obtained his veterinary degree, Masters of Preventative Medicine (MPVM), and poultry medicine residency training from the School of Veterinary Medicine at the University of California, Davis and is a board-certified Diplomate by the American College of Poultry Veterinarians.

Sociodemographic and Regional Determinants of Rabies Submission Bias in North Carolina

DR. RACHAEL URBANEK, CWB®, Associate Professor, University of North Carolina at Wilmington, urbanekr@uncw.edu

With North Carolina's human population and urban development rapidly expanding, spread of zoonotic disease is of concern to both wildlife managers and public health officials. Between 2008-2018, 300-1,000 wild terrestrial animals were submitted for rabies testing each year, however, only 30-46% of total submissions tested positive for rabies annually. Given the low percentage of positive tests and high number of submissions in some counties, we determined if a submission bias existed across the state for wild terrestrial species. Additionally, we investigated if income, age, education, gender, ethnicity, population density, housing density, and geographical region influenced total submissions and percent positive cases. Counties across the state differed in the average annual total submissions and average annual percent positive cases. Counties that are in the Piedmont region, and/or have higher percentages of White residents, denser human population and housing density, and/or more tourism income had the largest number of total submissions for rabies testing. Alternatively, counties that had higher percentages of residents who had attended some college submitted fewer animals for testing. Counties that had higher percentages of positive rabies cases were within the Piedmont and Coastal Plain regions and counties with higher percentages of Black and Hispanic residents. Alternatively, Mountain region counties and counties with higher percentages of White residents had lower percentages of positive rabies cases. Median age also had a negative effect on the percent of positive rabies cases. Determining which factors may influence submissions will identify where targeted educational rabies and wildlife programs are needed.

Bio: Dr. Rachael E. Urbanek is a Certified Wildlife Biologist®, TWS Fellow, and an Associate Professor in the Department of Environmental Sciences at UNCW. She earned her PhD from the Cooperative Wildlife Research Lab at Southern Illinois University Carbondale and her BS in Wildlife Science with a Forestry Minor from Penn State. Dr. Urbanek and her students research effective wildlife population monitoring field techniques, predator behavior around endangered species, and human-wildlife interactions to inform wildlife management by state, federal, and non-governmental agencies throughout NC.

Snake Fungal Disease, Chytrid Fungus, Ranavirus, and More

LORI WILLIAMS, CWB®, Wildlife Diversity Biologist, NC Wildlife Resources Commission, lori.williams@ncwildlife.org

Diseases of amphibians and reptiles are a serious threat to biodiversity worldwide. Closer to home, we too are dealing with the complexities and potential ramifications of viral and fungal pathogens, such as *Bd* (*Batrachochytrium dendrobatidis*), a type of chytrid fungus that can cause the disease chytridomycosis, Ranavirus which affects both reptiles and amphibians, and *Oo* (*Ophidiomyces ophiodiicola*, a fungus that can cause Snake Fungal Disease (SFD). Further, an emerging threat for salamanders in particular is *Bsal* (*Batrachochytrium salamandrivorans*), a native of Asia and another deadly type of chytrid fungus. So far, *Bsal* has not been found in North America but poses tremendous risk to native salamanders and is something that could significantly affect species diversity and negatively impact amphibian communities nationwide. In the last decade, more research on the infection pathways for these herp diseases, species susceptibilities, and mitigation strategies have become available, yet so much work remains. In this presentation, I will briefly give an overview of these pathogens and share what we know so far about their presence in NC, along with our surveillance efforts. Finally, I will very briefly outline the national Rapid Response Plan for *Bsal*, in the event (some say likely event) it arrives on US soil.

Bio: Originally from Raleigh, NC, Lori Williams, is a Wildlife Diversity Biologist for the NC Wildlife Resources Commission and a Certified Wildlife Biologist® by The Wildlife Society. She has a BS in English, Secondary Education from Appalachian State University (1993), a BS in Wildlife Science from Virginia Tech (2000), and a MS in Fisheries and Wildlife from Virginia Tech (2004). Based near Asheville, NC, Lori coordinates and conducts western region amphibian inventory, monitoring, and research projects for the NCWRC, often collaborating with numerous and diverse partners. She has worked in wildlife conservation and ecology for 23 years.

Canine Distemper Virus Outbreak in a Population of Eastern Spotted Skunks

DR. DAVID JACHOWSKI, Associate Professor of Wildlife Biology, Department of Forestry and Environmental Conservation, Clemson University, djachow@clemson.edu

Canine distemper disease can cause high mortality rates in carnivores, such as mustelids, and can have important deleterious effects on vulnerable, often small, carnivore populations due to its highly transmissible nature. In April and May 2020, we recovered 5 Eastern Spotted Skunk carcasses over a 15-day period that showed no visible signs of trauma. Clinical examination of the carcasses indicated that the skunks died due to canine distemper. Four of these skunks were radio-collared as part of our research at the time of their deaths, meaning that 50% of our study sample succumbed to distemper. Additionally, 2 other skunks we had radio-collared went missing during this time and might have contracted and died of distemper as well. To our knowledge, this is the first documented outbreak of distemper in Eastern Spotted Skunks. Our observation underscores the need to further study the effects of disease on the declining Eastern Spotted Skunk across its range.

Bio: Dr. David Jachowski is an Associate Professor of Wildlife Biology in the Department of Forestry and Environmental Conservation at Clemson University. Dr. Jachowski has been studying the ecology and conservation of small carnivores for over 20 years and is the founder and immediate past chair of the Eastern Spotted Skunk Cooperative Study Group, a species his lab group has studied across multiple US over the past decade. Dr. Jachowski also leads research on a variety of other mammals of management concern globally, ranging from African elephants to least weasels, with a common goal of undertaking ecological studies to inform management action.

Posters

Comparing LiDAR and Field-measured Vegetation Data to Predict Forest Bird Habitat Associations

DARIN J. MCNEIL PhD[1], Jeff Atkins PhD[2], Andrew Elmore PhD[3], Cameron J. Fiss MSc[4], Jonathan Cohen PhD[4], Matt Fitzpatrick PhD[3], Jeff L. Larkin PhD[5]

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Habitat loss and degradation remain among the greatest threats to native wildlife populations across North Carolina and beyond. Although North Carolina hosts abundant forest, many wildlife species dependent upon tree-dominated landscapes are experiencing steep population declines with degradation of forest structure a commonly cited driver of these losses. As a result, numerous timber management efforts have been initiated to create/enhance forest stands for associated wildlife species. Evaluations of management efficacy require not only monitoring the responses of focal wildlife species, but also the structural habitat characteristics to which species of interest may respond. One increasingly available tool that can be used to understand wildlife x habitat relationships is Light Detection and Ranging (LiDAR) data. Data derived from LiDAR provide a three-dimensional examination of habitat structure from the ground through the outer canopy, offering a detailed perspective of habitat structure otherwise difficult to obtain with traditional field measurements or through most remote-sensed data types. To assess the potential merit of LiDAR for predicting species responses to forest management, we combined point count data on the imperiled Golden-winged Warbler (*Vermivora chrysoptera* [from 2019-20; 1,573 locations]) in northern Pennsylvania with two sources of habitat data: 1. those from field-measured vegetation surveys and 2. derived from a newly-published statewide LiDAR dataset. Single season occupancy models revealed that LiDAR was more predictive than either a null model (intercept-only) or models using field-measured vegetation data. LiDAR models also revealed patterns consistent with literature on the species' life history (*e.g.*, associations with open canopy and dense understory vegetation). Finally, we also demonstrate how LiDAR data can be used to simulate Golden-winged Warbler habitat management to better understand species responses to conservation efforts. Collectively, these results indicate that LiDAR data are both highly useful in predictive models and may characterize forest habitat structure better than traditional methods.

Indirect Effects of the COVID-19 Pandemic on Wildlife Activity on an Urban Campus

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The COVID-19 pandemic has upended many people's lives, and the subsequent change in human activity has the potential to affect that of local wildlife. We aim to assess the indirect impacts of the pandemic on wildlife activity on the University of North Carolina Wilmington (UNCW) campus and surrounding urban community. From 28 August - 23 October 2020, we deployed individual passive infrared game cameras at 18 sites to capture animal activity along trails within a ~78ha longleaf pine (*Pinus palustris*) forest. Many changes to UNCW campus life occurred within that time frame: classes were moved online, in-person events got cancelled, students were sent to quarantine, and half the freshman class were moved off-campus. We plan to regress human activity (e.g., # of human or car image events), the number of positive COVID-19 cases, the number of students in face-to-face classes, and the number of residential students onto the number of image events for several species to investigate which of these factors may influence a change in wildlife activity. We also plan to compare circadian activity patterns of several species with data on UNCW and New Hanover County COVID-19 cases and campus social distancing efforts to assess potential temporal effects on wildlife activity. The interdisciplinary nature of this study borrows from fields like sociology, epidemiology and public health and combines them with the wildlife sciences. As such, the results of this study could provide insight into species' responses to sudden changes in human activity in an urban setting and any indirect impacts of societal public health measures on wildlife populations.

Determining Use, Economic Impacts, and Value of Game Lands in North Carolina

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America's parks and protected areas, including wildlife refuges and wildlife management areas (WMAs), receive over 2 billion visits each year. With such high use, it's important to understand the environmental, social, and economic impacts associated with these properties. From an economic perspective, WMAs have market and non-market value to visitors and residents and may have substantial impacts on local economies. Quantifying economic contributions and value can inform decisions about investment in and management of public lands. To this end, we estimated the economic contributions of game lands in NC, willingness to pay (WTP) for game land conservation by users, and the value of game lands to nearby residents as reflected in real estate transactions. We collected data on visitation and conducted intercept surveys at 9 game lands. Using census and real estate data, we estimated how proximity and adjacency to game lands were capitalized into housing prices. We modeled annual visitation at all 94 NC game lands using a predictive model. We estimated that in 2018 game lands received approximately 2.2 million visits, resulting in $180 million in game land related expenditures, 2,200 jobs, and over $84 million in labor income, all of which contributed more than $140 million to NC's GDP. Users who participated in both licensed (hunting & fishing) and non-licensed activities (all other activities) had a higher WTP ($164.69) than users who exclusively participated in non-licensed ($147.33) or licensed activities ($130.72). WTP increased with the number of visits per year, the number of activities in which the respondent participated, education and income. We documented that living near a game land may increase property value, but the relationship was highly location dependent. This research may help facilitate negotiations among stakeholders impacted by WMAs and highlight instances where WMAs are currently an underutilized source of economic growth.

Coyote Attraction to Predator Exclusion Cages

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Coyote (*Canis latrans*) depredation of sea turtle nests is a growing concern in North Carolina and while several designs for predator exclusion cages (PECs) have been published, no one PEC is 100% effective. We hypothesized that PECs may increase the chance of depredation on sea turtle nests if they act as a visual cue to coyotes. We tested this hypothesis using camera traps and two PEC designs on Bald Head Island, North Carolina between 11 May- 28 June 2021. We replicated each PEC design 5 times on South Beach and used West Beach as a control with only camera traps. PECs were not baited or placed over turtle nests; PECs were the only novel stimuli. We quantified coyote presence and absence, the number of coyote events, and aspects of observed coyote behaviors. Latency to detection for coyotes was similar on both beaches throughout the study. In the week prior to the first PEC deployment, we detected coyotes at a higher proportion (paired $t_7 = 3.26$ $P = 0.014$) of South Beach cameras (0.26 ± 0.06; mean ± SE throughout) than on West Beach (0.10 ± 0.04). There was no difference in coyote detections in the remaining weeks. Similarly, we observed more coyote events (paired $t_7 = 1.16$ $P = 0.008$) on South Beach (0.40 ± 0.11) than on West Beach (0.19 ± 0.06) during the first week of PEC deployment but there was no difference the remaining weeks. Coyotes appeared to spend ~14 seconds longer around PECs compared to the camera trap controls, but the difference was not significant. Coyote behavior was similar between sites, wherein the most common behavior was standing nearby. Our results indicate that PECs do not act as a visual cue to coyotes which will provide flexibility for sea turtle management in choosing PEC designs.

Efficacy of Wildlife Underpasses 15 Years Post-construction

ABBY R. WEINSHENKER[1], Rachael E. Urbanek PhD[1], Colleen Olfenbuttel[2], Travis Wilson[2]

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In 2005, a new section of U.S. Highway 64 in Washington County, North Carolina was completed that intersected prime black bear (*Ursus americanus*) and white-tailed deer (*Odocoileus virginianus*) habitat. Three wildlife underpasses were installed with a 3-m-high chain link fence extending ≥800 m from each underpass in both directions and parallel to the highway. Over time, this fencing has developed gaps, potentially reducing the efficacy of the underpasses. Since October 2019, we have been monitoring wildlife activity using passive infrared cameras at the underpasses (3-4 each) and 15 fence gaps (1 each) in fencing. Our goal is to determine differences in species use of the fence gaps vs. underpasses and what factors influence wildlife crossing behaviors. Preliminary results indicate wildlife crossing behaviors are species-specific. Rodents and deer were observed >55% using the underpasses while aquatic mammals, bears, bobcats (*Lynx rufus*), canids, opossum (*Didelphis virginiana*), rabbits (*Sylvilagus* spp.), and squirrel (*Sciurus* spp.) were detected >55% using the gaps in the fence. Raccoons (*Procyon lotor*) were detected equally using underpasses and gaps. Cameras at the fence gaps will be deployed through October 2021. We will assess seasonal wildlife crossing behaviors and investigate if COVID-19, via a change in possible highway traffic, had any effect on the crossing behaviors. We will also regress species, season, year, gap size, gap distance from underpass, and the frequency a species was walking parallel with fence onto the proportion of events a species was observed using the gaps (i.e., observed on the unsafe side of highway). Wildlife exclusion fencing is often neglected, and post-construction studies generally focus on the crossing structure. When fencing is left unattended, gaps develop, causing the potential for more wildlife-vehicle collisions. The purpose of this study is to emphasize the importance of maintaining the fencing that is paired with wildlife crossing structures.

Resource Selection of Black Bears and a Before-after Experiment to Evaluate Impacts of Bear Education

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Bear education programs can be effective in reducing human-bear interactions; however, quantitative data are lacking to understand the spatial responses of bears to these initiatives. Similarly, opportunities to examine the concurrent perceptions and experiences of residents participating in a bear education program are few. Thus, our objectives are to live-capture and GPS radio-collar 23 female black bears to evaluate before-after impacts of a bear education initiative on urban black bear space use and resource selection. We will educate Asheville communities via BearWise, a regional bear education program that promotes responsible co-habitation with black bears through bear-proofing strategies and quantify anthropogenic resource availability and selection via ground-truthing of bear locations to reveal attributes associated with urban black bear resource selection. Also, we will survey Asheville residents to better understand resident attitudes towards bears, human-bear interactions, and efficacy of the BearWise program/initiative in reducing human-bear interactions. We aim to provide a before-after measure of the effectiveness of the BearWise program through observed changes (if any) in bear movements and home range size, as well as evaluating public attitudes and willingness to actively participate in the management process through bear education programs.

Investigating the Source of Contamination for Organochlorine Pesticides Causing Raptor Fatalities in the Southeastern US

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Despite the general trend of organochlorine residues decreasing in the environment, since 2016 the Carolina Raptor Center (CRC) has received raptors presenting with neurologic dysfunction, a potential sign of potential pesticide toxicity, ultimately resulting in death regardless of treatment. Following extensive investigation, it has been determined that some of these fatalities appear to have been caused by extremely high levels of organochlorines. If the unknown pesticide source is discovered, then conservation groups can begin to formulate a plan to control exposures. The goal of this study is to determine whether exposure to organochlorines is limited to migratory raptors. If limited to migratory raptors, perhaps these birds are being exposed in other countries where organochlorine pesticide use is still legal. Around 30 raptor carcasses were acquired from the CRC and represent a random subset of admitted birds with no pattern of cause of death or symptoms, evenly distributed between migratory and nonmigratory raptors. One goal of this study is to determine how widespread the organochlorine residue problem might be outside of birds presenting with significant symptoms. Our general procedure will be to add TCMX/DCBP as internal standards to each sample and grind the sample with sodium sulfate. We will then add 20mL of hexane and agitate it for 24hrs to enhance extraction. Following shaking, 11mL of this solution will be added to a QuEChERS kit for cleanup and vortexed for 1min. We will then remove 10mL of the sample and evaporate it to dryness using a rotary evaporator before reconstituting the sample in 1mL of hexane for analysis via GC-MS, which will use a standard mix of 17 organochlorine pesticides for quantification of residues. We are currently testing this system on commercially available chicken livers to determine extraction efficiency prior to extracting raptor liver and brain tissues.

Method Development for Orally Dosing Brook's House Geckos for Pesticide Risk Assessment

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Control of invasive species requires many tools and approaches. Pesticides are a useful tool in species control and have effectively eradicated invasive mammals from islands around New Zealand. However, the use of pesticides to control invasives needs to be assessed for risk of toxicity to native species. The goal of this project is to assess risk of pesticides (used by the New Zealand government to control invasives) to Brook's house gecko (*Hemidactylus brookii*) as a surrogate for native New Zealand geckos. Oral toxicity will be assessed using gelatin capsules dosed using a pseudogavage method in which the capsule is inserted into the throat of the organism. However, we have run into two issues while developing methods for our experiments. First, dosing small lizards (< 4.0 g in most cases) creates problems in weighing out pesticides using typical analytical balances that quantify to single digit milligram levels. Second, during our pilot experiments, we had over 75% of our lizards regurgitate the provided capsule. Here we report on solutions to these issues. The solution to the regurgitation issue appears to be the use of a gavage tube to ensure the dose is delivered into the stomach of the lizard. Using the gavage tube, we tested 3 capsules and found no regurgitation. Regarding problems related to weighing out very small doses, we tested a method of dissolving the pesticide in solvent and then adding aliquots to capsules and allowing the solvent to evaporate. We dissolved an herbicide (pendimethalin) in both acetone and acetonitrile and then pipetted an aliquot designed to provide 8.6 mg of pesticide into the capsule. After 48 hours, the average residue for acetone was 8.8 mg, and acetonitrile was 6.9 mg, suggesting that acetone might be a better solvent to use for aliquoting doses of pesticides into capsules.

More Than Just Algae: Additional Evidence to Support Tadpoles as Omnivores Using *Hyla chrysoscelis* Tadpoles

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Although tadpoles are commonly thought of as herbivorous, increasing evidence supports the idea that most species are omnivores. The importance of protein in the diet of Cope's Gray Treefrog (*Hyla chrysoscelis*) tadpoles has not been evaluated. We opportunistically conducted a feeding trial comparing the size at metamorphosis of frogs fed 5 different diets as tadpoles with varying amounts of protein. Being larger at the time of metamorphosis has been linked to higher survival rates and serves as a good indicator of optimum diet. The tadpoles originated from mesocosms for a different project and were transitioned indoors, to these specific diets at mid-stage development (Gosner stages 30-38) and fed ad libitum through metamorphosis. The 5 diets included: only tadpole food (50% protein), only crushed spinach, only crushed rabbit food (12% protein), both crushed spinach and tadpole food, and both crushed rabbit food and tadpole food (3:1 mixture). The tadpoles were raised in mason jars with a bubbler and a maximum density of 3 tadpoles at the start of the experiment. We exchanged part of the water every 3-5 days, allowing for coprophagy. We removed the tadpoles from the jar when they started climbing the walls and measured length and mass when the tail was fully resorbed. If the tadpoles were strictly herbivorous then we would expect those raised on crushed spinach to be the largest after metamorphosis. However, the tadpoles fed crushed rabbit food and tadpole food resulting in the largest frogs at metamorphosis, providing strong support for this species being omnivorous. Understanding the dietary needs of common species can be useful for future captive rearing or predicting needs of species of conservation concern.

The Impact of Constructed Wetlands on Wildlife Ecology

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In March of 2017, UNCG constructed two wetlands on campus. Before construction, ultrasonic detectors and microphones were mounted at each wetland and corresponding controls to record bats. We found that there was no difference in bat species richness and diversity between the control sites and the wetland sites before construction. After construction, there was an increase in the species richness and diversity at the wetland sites. Further study, in later years, showed that this difference in their biodiversity diminished over time. Furthermore, it appears that the dominant species for that site changed over the years. An important question to ask is what is causing the differences among bat communities at the constructed wetlands over time. We propose two studies that address this question. The first study is a test of the hypothesis that restoration activity in wetlands impacts mammal diversity. We propose in-depth observations of bats to assess diversity and activity patterns at selected wetlands including a wetland restoration area in the Stinking Quarters Creek, Central North Carolina. The second study tests the hypothesis that water quality impacts arthropod abundance in constructed wetlands. Existing literature shows that different species of bats have specific water quality and arthropod needs, both of which may change over time due to factors such as human traffic, new vegetation, and water quality. We will focus on measuring the impact of conductivity, total organic carbon, dissolved organic carbon, and total suspended solids on arthropod population diversity and abundance in the wetlands at UNCG and other areas in central North Carolina. Our studies will provide insight into how water quality and food resources affect mammal and arthropod species diversity.

Business Meeting Agenda

Thursday, February 17, 9:00 am
The Trinity Center, Pine Knoll Shores, NC

Welcome and Opening Comments – Matthew Harrell

Secretary's Report – Dr. Liz Hillard
Review and approval of minutes from the December 9, 2021 Executive Board meeting; minutes are available at http://nctws.org/wordpress/members

Treasurer's Report and 2021-2022 Budget – James Tomberlin
Report is available at http://nctws.org/wordpress/members

Committee Reports – Committee Chairs
Reports are available at http://nctws.org/wordpress/members

Student Chapter Updates
NC State University
Haywood Community College
Western Carolina University
University of North Carolina Wilmington

Election Results – Matthew Harrell, CWB®
Present new officers and "Passing of the Goat"

Words from the New President – Danny Ray, CWB®

Awards

NCTWS CHAPTER AWARD

This award is presented to a chapter member for individual effort and contributions to wildlife conservation through The Wildlife Society. Service to the Society and Chapter is strongly considered, along with professional achievement. The award includes a certificate or plaque and a copy of the commendation read during the awards ceremony. Presentation to the recipient is typically made at the annual meeting of the Chapter.

WILDLIFE CONSERVATION AWARD

This award is presented to individuals or groups within North Carolina who deserve recognition for achievement in wildlife conservation, education, research or related endeavors. There is no requirement for Society or Chapter membership. The recognition is for accomplishments widely recognized and publicized. The award includes a certificate or plaque and a copy of the commendation read at the awards ceremony. The award is presented to the recipient or organization at a time and location that is meaningful to the recipient and to the Chapter in terms of future interaction with others who work for the betterment of wildlife conservation.

KEN WILSON MEMORIAL AWARD

The Ken Wilson Memorial Award is presented annually to a student or students, nominated by the wildlife faculty of the various schools within the State having student chapters (NC State University, Haywood Community College, Western Carolina University, and University of North Carolina Wilmington) and selected by the Awards Committee. Awards are presented for academics, contributions to research, work projects that contribute to State wildlife conservation efforts, involvement with the student chapter of The Wildlife Society, and other accomplishments that the Chapter deems worthy of recognition. Recipients receive a cash award, a plaque, a copy of the Sand County Almanac, and a copy of the commendation signed by the Chapter President.

BEST POSTER AWARD

This award is given to a Chapter member for the most outstanding poster presented at the annual meeting. The poster must be presented during the specified poster session period when the poster evaluation is performed.

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