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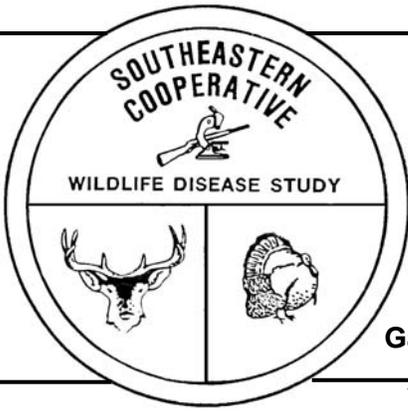
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SCWDS BRIEFS

A Quarterly Newsletter from the
Southeastern Cooperative Wildlife Disease Study
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Piroplasmosis Hits Missouri Horses

On June 4, 2009, the Missouri Department of Agriculture (MDA) was notified of a piroplasmosis-positive horse being treated at the College of Veterinary Medicine at Kansas State University that originated from a stable in Raytown, Missouri. The MDA immediately quarantined the facility, and on June 9 blood samples taken from seven of 63 horses at the facility tested positive for equine piroplasmosis (EP) at the USDA-APHIS-Veterinary Services' National Veterinary Services Laboratories. The index positive horse was moved back to the Raytown stables on June 12, 2009. Two of the positive horses, including the index positive horse, were illegally removed from the premises on June 17, 2009, and the remaining five positive horses were euthanized on June 18 with their owner's consent. The ongoing search for the two stolen horses involves multiple agencies, including USDA, MDA, Missouri Highway Patrol, and the FBI.

Equine piroplasmosis affects horses, donkeys, mules, and zebras and is a foreign, tick-borne disease caused by the blood protozoans *Babesia caballi* and *Theileria equi*. USDA-APHIS-VS regulates equine importation and maintains tick control and surveillance programs to protect the equine industry of the United States against the entry and spread of EP.

The disease initially was detected in this country in Florida in 1960, and a State-Federal EP control program was initiated in 1962. Eradication efforts were successful, and the United States was declared free of EP in 1988. However, EP has been detected in the United States occasionally since 1988, including in 2008 when infected horses were found on five premises in Florida and were euthanized (see SCWDS BRIEFS, Vol. 24, No. 3).

At the request of MDA and USDA, SCWDS has just completed surveys at the Raytown, Missouri, premises to determine if EP had spread to native tick vectors. These surveys were similar to those conducted by SCWDS at the EP-positive premises in Florida in 2008. Surveys at the Missouri premises were conducted in late June 2009 and included extensive surveys for ticks via examination of wildlife and tick drags, but only four ticks (three specimens of *Ixodes texanus* and one *Amblyomma americanum*) were collected from 38 animals, one human, and 3,320 m of tick drags. Of note, *Dermacentor variabilis*, a tick that is common in Missouri and also is a known experimental vector of EP, was not found at the premises, even though adults of this tick are active and most abundant during the summer.

Because so few ticks were collected during these extensive surveys and none of the species collected were vectors of EP, there is no evidence of spread of the EP agent from the affected horses to ticks in the area. These surveys were supported through a Cooperative Agreement for Arthropod Surveillance with the USDA-APHIS-VS' National Center for Import and Export and a Cooperative Agreement for Emergency Preparedness with USDA-APHIS-VS. (Prepared by Joseph Corn)

Cytauxzoon felis in Wild Felids

Cytauxzoon felis is a tick-transmitted protozoan parasite first described in domestic cats from Missouri in 1976. The parasite causes progressive, febrile illness (cytauxzoonosis) in domestic cats that frequently is fatal. The parasite has both an intraerythrocytic phase, in which the red blood cells are infected by a form of the parasite called piroplasms, and a schizogenous tissue phase that develops in macrophages. The latter is responsible for the

Continued...

clinical presentation of the disease in domestic cats, as infected macrophages occlude blood vessels in the lungs, spleen, liver, and lymph nodes.

Deaths of domestic cats due to *C. felis* infection have been reported from a number of southeastern and south central states. Because infected domestic cats usually die quickly, they historically have been considered dead-end hosts; however, recent research suggests that domestic cats can remain asymptomatic, serve as reservoirs for the parasite, and subsequently infect tick vectors. Bobcats (*Lynx rufus*) are presumed to be the primary reservoir species for this parasite because prevalence of the parasite in bobcats is high in endemic regions, but clinical cytauxzoonosis generally is not reported (only a single case reported in a young bobcat from Kansas in 2000). Piroplasms are commonly detected in the blood of endangered Florida panthers (*Felis concolor coryi*), but molecular analysis has shown that the majority of these piroplasms are caused by a species of *Babesia*. Panthers infected with *C. felis* had mild hemolytic anemia and probable liver damage, suggesting that this parasite can cause some disease among Florida panthers. This parasite also has been reported to cause fatal cytauxzoonosis in many exotic and wild/captive felids in North and South America.

Experimental transmission studies have shown that *C. felis* can be transmitted by two tick vectors: the American dog tick (*Dermacentor variabilis*) and the lone star tick (*Amblyomma americanum*). The distributions of these ticks overlap considerably throughout the eastern United States, but *D. variabilis* ranges farther north. *C. felis* has been detected in ticks collected from a parasitemic cat in Missouri, but no published studies have identified *C. felis* in questing wild ticks.

In recent years, several studies have indicated that some domestic cats can survive and become subclinical reservoirs. This survival may be due to the increased screening efforts or to intraspecific variation in the virulence of the parasite to domestic cats. A recent study published by other researchers at the University of Georgia's College of Veterinary Medicine found that at least three genotypes of the parasite are circulating in domestic cats in Arkansas and Georgia, and there is an

association between particular genotypes and the survival of infected cats (Brown et al., 2009, *Journal of Veterinary Diagnostic Investigation* 21:59-63).

Recently, SCWDS was awarded a grant from the Morris Animal Foundation to study this parasite in wild felids and field-collected tick vectors. Goals of this project are to better understand the range of this parasite in wild felids, determine which tick species is naturally infected more often, and to genetically characterize *C. felis* strains detected in wild felids and ticks. To obtain spleen and/or blood samples from wild felids, we have received excellent assistance from numerous state and federal agencies and university researchers in Georgia, Kansas, Kentucky, Louisiana, Missouri, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, and West Virginia. These samples are being screened for *C. felis* by polymerase chain reaction (PCR), and all positive samples are further characterized by genetic sequence analysis. These sequences will be compared to those previously detected in domestic cats and to any sequences we detect in ticks.

We have tested samples from 460 wild felids (418 bobcats and 42 panthers/cougars) from 11 eastern states. Our data confirm that *C. felis* is common in some bobcat populations, but significant differences in prevalence exist between southern and northern states. These differences in prevalence likely are related to the differences in the distributions and densities of the two tick vectors. For example, only 3% of bobcats from North Dakota were positive for *C. felis*, while no bobcats from West Virginia or Ohio were positive. These three states have *D. variabilis* populations, but either lack or have very low numbers of *A. americanum*. States with high numbers of *D. variabilis* and *A. americanum* have a high prevalence of *C. felis* in bobcats: Kentucky, 55% prevalence, Missouri 79%, Oklahoma 60%, and North Carolina 63%. Intermediate prevalences were detected in bobcats from Georgia, Kansas, Louisiana, and South Carolina. These data confirm the presence of *C. felis* in numerous southeastern and Midwestern states, but we have detected *C. felis* in some states (e.g., North Dakota) where infection in domestic cats has not been reported.

Our surveillance of wild felids will continue throughout this year, and we welcome additional

samples if they become available. We also will screen over 2,000 wild questing *D. variabilis* and *A. americanum* ticks collected from Georgia, Kentucky and Tennessee to determine the prevalence of *C. felis* in the tick vectors. Once the surveillance of wild felids and ticks has been completed, we plan to map the genetic variability of *C. felis* from these samples to determine if there are any spatial differences in strains. In addition, these strains will be compared to those from domestic cats. These data will increase our knowledge of the natural history of *C. felis*, which will assist veterinarians, researchers, and wildlife professionals to better understand the risks this parasite poses to domestic and wild felids. (Prepared by Barbara Shock and Michael Yabsley)

SCIF & Mossy Oak Fund HD Research

Safari Club International Foundation (SCIF) and Mossy Oak have teamed up to support SCWDS research on hemorrhagic disease (HD), the most significant viral disease of white-tailed deer, through a contribution to the Southeastern Cooperative Wildlife Disease Study. The two organizations are jointly funding a conservation research project investigating reasons for the expansion of HD, which is caused by epizootic hemorrhagic disease viruses (EHDV) and bluetongue viruses (BTV) carried by biting midges in the genus *Culicoides*. The ultimate goal of the research is to understand HD epidemiology well enough to predict or even prevent future spread of the disease.

The epidemiology of HD in white-tailed deer is well described; however, some components in this system could be impacted by changing climatic conditions. These epidemiological alterations could result in increased morbidity and mortality in deer populations, a northern expansion of the range of HD, an increase in the frequency of disease events, and the incursion and establishment of "new" EHDV and BTV viruses into the United States. Some of these possibilities were suggested in 2007, when HD caused unprecedented deer mortality in areas in the eastern United States where historically it had been absent or caused milder disease. The northern range of HD (where most deer mortality occurs) corresponds to the known range of *C. sonorensis*, and climatic conditions affecting this vector's range and abundance could translate

into increased problems with HD. In addition, viral replication within the vector can be temperature dependent: a minimum temperature or a minimum duration of permissive temperature may be required for virus to replicate to a sufficient level for transmission to occur. This is one variable that may expand the range of HD by providing improved conditions for vector competence. Another variable we will examine is altered virulence of HD viruses due to genetic differences between viruses from different outbreaks.

SCWDS has been a leader in HD research for many years and we continue to make strides in understanding its epidemiology. However, a disease system as complex as HD, with multiple causative viruses, insect vectors, and wild hosts, creates new challenges and questions just when we think we may have answered some of the older questions. We are grateful to SCIF and Mossy Oak for their support for HD research, not only for the money they are providing, but also for the confidence they have shown in SCWDS.

Safari Club International Foundation is a 501(c)(3) nonprofit charitable organization that funds and manages programs in North America and overseas. Since 2000, SCIF has provided more than \$47 million in funding for wildlife conservation, wildlife education, and humanitarian services work. The SCIF funds research programs with proceeds from its annual hunters' conference, contributions from chapters, individual member contributions, and through generous support from corporations like Mossy Oak who are committed to bettering the science of wildlife management. To learn more about SCIF, visit www.sci-foundation.org. Mossy Oak, a leading designer and manufacturer of camouflage clothing and other hunting supplies, is known throughout the world for its superior products and service to customers. Mossy Oak also has a history of giving back to leading causes and programs that support hunters and conservation. Additional information on Mossy Oak can be found at www.mossoak.com/.

Individuals, private companies, and organizations wishing to support SCWDS research can donate to the Southeastern Wildlife Health Development Fund, a 501(c)(3), nonprofit organization. For additional information on our development fund, please visit www.scwds.org. (Prepared by John Fischer)

Hardware Disease in a Key Deer

On April 4, 2009, a homeowner on Big Pine Key, Florida, called personnel at the Key Deer National Wildlife Refuge (KDNWR) to report a lame female Key Deer that refused to leave the homeowner's yard. The deer was limping badly on the right front leg and had not left the yard in two weeks. She was captured by personnel from the KDNWR, and was euthanized due to her poor nutritional condition and severe musculoskeletal disease. The carcass was frozen until it could be examined by SCWDS personnel. The age of the deer was estimated to be eight years or more.

A thorough postmortem examination performed by SCWDS diagnosticians revealed that a piece of stainless steel wire approximately 1-mm in diameter and 3-cm long had caused traumatic reticulopericarditis, or hardware disease as it is more commonly known. Hardware disease is a common diagnosis among domestic ruminants, particularly cattle. The condition occurs when ruminants unintentionally ingest sharp metal objects while grazing. The objects settle in the reticulum, the lowest portion of their complex stomach. The reticulum lies adjacent to the diaphragm and is separated by that thin sheet of muscle from the heart. In this instance, the wire had penetrated the reticulum and extended through the diaphragm to the caudal surface of the heart. Although only mild inflammation was present on the surface of the heart, it likely would have progressed to a fatal inflammation of the heart's surfaces. The outside surface of the reticulum was infected, and a 6-cm diameter focus was covered in a sheet of fibrin that contained pus (Figure 1). The inner surface of the reticulum was not inflamed, although the foreign body was still present (Figure 2).

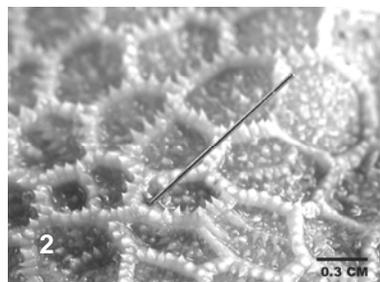
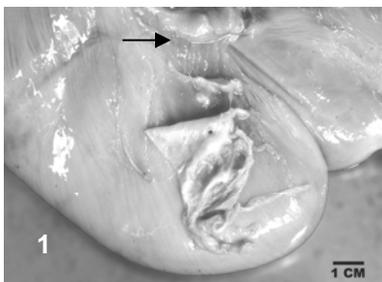
Also discovered at necropsy was severe arthritis of the right carpal and metacarpal joints and a sloughed lateral right front dewclaw. The left retropharyngeal lymph node was obliterated by an abscess. It is possible, but not proven, that the infection stemming from the penetrating foreign body could have resulted in sepsis, culminating in arthritis and suppurative lymphadenitis.

Although traumatic reticulopericarditis is an uncommon diagnosis among free-ranging cervids, its presence among Key deer is not altogether surprising. This endangered subspecies of white-tailed deer has been greatly impacted by human encroachment and development. The principal population is restricted to Big Pine Key, particularly the KDNWR. Even though a refuge is established for these deer, human interactions are common, and deer often are found in residential areas. They have become habituated to people due to a common practice of feeding the deer. Because of their presence in residential areas and the presence of debris distributed across the islands by hurricanes, the ingestion of foreign bodies is not uncommon. Postmortem examinations performed by SCWDS and KDNWR personnel frequently have detected materials in the rumen, most commonly rope or bits of plastic. In this instance the wire ingested by the deer was sufficiently sharp and stiff to work its way through the reticulum and progress through the diaphragm to the heart. The source of the wire was not confirmed, but it appeared similar to the type of wire used for fishing leaders.

We thank Tom Wilmers, KDNWR, for his submission of this material and for his continued concern over the health of the Key Deer population. (Prepared by Kevin Keel)

Swine Brucellosis Infects Hog Hunters

The Centers for Disease Control and Prevention (CDC) recently reported three human cases of swine brucellosis (undulant fever) that were associated with feral hog hunts in Florida in December 2007 (CDC MMWR June 12, 2009/58; 617-621). Two of the hunters were exposed on the same hunting trip, while the third acquired the disease in a separate event. All three became infected after field dressing and butchering feral swine without adequate personal protective



equipment; one person cut his hand while field-dressing a feral hog.

Swine brucellosis is caused by *Brucella suis*, a zoonotic bacterial pathogen carried by swine. Historically, in humans it was seen primarily in swine slaughterhouse workers. Since 1972, when the USDA's National Brucellosis Eradication Program was expanded to include swine herds in addition to cattle, the disease has been eliminated from domestic swine. There are far fewer human cases in the United States today, due to elimination of *B. suis* from commercial swine, and most infections are associated with exposure to infected feral swine.

Feral hog distribution has expanded greatly in the last two decades, thanks primarily to human-facilitated movement. Wild swine have been reported in 35 states, with the largest numbers occurring in California, Florida, Hawaii, and Texas. Evidence of *B. suis* infection among feral swine has been found in 10 states. (The National Feral Swine Mapping System, which depicts real-time distribution of feral swine, was developed and is maintained by SCWDS, can be found at <http://128.192.20.53/nfsms/>)

Human brucellosis infections, which are caused by *B. suis*, *B. abortus*, *B. melitensis*, and *B. canis* and are reportable in all 50 states, can be very difficult to diagnose because of vague signs and symptoms. In fact, two of the patients in the recently reported cases did not experience symptoms until 4-6 months after exposure. Humans may become infected with *B. suis* through skin wounds, inhalation of infectious particles, or by consuming unpasteurized dairy products or contaminated meat that is improperly cooked. Signs and symptoms in humans may include intermittent fever, chills, malaise, arthralgia, headache, anorexia, and fatigue. Two patients in the recent report had fevers that lasted approximately one week and unintended weight loss over 4-16 weeks.

Untreated cases can last several weeks to years and may lead to abscesses in the liver, spleen, heart valves, brain, or bone, and, in rare cases, death. Fortunately, human brucellosis responds to treatment, and two of the three hog hunters in the recent report recovered after six weeks of antibiotic therapy. Although treatment was recommended to the third hunter, he was lost to follow-up.

According to the CDC, efforts to prevent *B. suis* infection should focus on education of hunters and partnerships between states and local public health, wildlife, and agriculture agencies and sportsmen's associations. Educational materials for feral swine hunters should include recommendations for safe field dressing, butchering, and cooking. (Prepared by Yandace Brown, University of Georgia College of Veterinary Medicine Class of 2010)

SCWDS Personnel Changes

When Dr. Justin Brown completed his PhD in 2007, he accepted a post-doctoral position with SCWDS to continue his work on avian influenza virus in wild birds and to serve as a member of the team of SCWDS diagnosticians who handle the clinical cases that are submitted for examination. This temporary position has ended, and Justin has been hired as an Assistant Research Scientist. He will continue his important research on avian influenza viruses and will continue to assist with the diagnostic service. Justin is a devoted, enthusiastic, and conscientious researcher, and we are fortunate and happy that he has decided to remain on our staff.

On July 1, 2009, Dr. David Stallknecht was promoted from Associate Professor to Professor. As one of the smartest, most dedicated, and hardest working members of the SCWDS "family," David has more than fulfilled the requirements for that position, and we are pleased that his accomplishments are recognized by his colleagues at the College of Veterinary Medicine and University of Georgia. Among his many talents, David is widely recognized as a leading authority on the viruses that cause hemorrhagic disease in deer and on the epidemiology and ecology of avian influenza viruses in wild birds. Through his world-class research, he continues to make inroads into unraveling the mysteries that surround these significant diseases. Congratulations, David.

Dr. Steven Kubiski graduated from the University of Georgia's College of Veterinary Medicine in May 2009 and has accepted a post-doctoral position with SCWDS. Steven's main duties will be assisting Dr. Kevin Keel with diagnostic cases and coordinating our CWD testing service. To his credit, while still in vet school Steven was

responsible for starting a student chapter of the Wildlife Disease Association at the University of Georgia in early 2008. The chapter's listserv reaches about 80 students and faculty from the College of Veterinary Medicine, the D.B. Warnell School of Forestry and Natural Resources, and the Odum School of Ecology. Good job, Steven!

John Wlodkowski has returned to SCWDS after more than 10 years at other jobs. When John completed his BS degree from the University of Georgia's D.B. Warnell School of Forestry and Natural Resources in 1994 he came to work at SCWDS as a research technician, primarily involved with developing new types of oral baits for the delivery of vaccines to wild and feral animals. When John left SCWDS in 1998, he continued this work with the world-leading animal health company, Rhône Mérieux (now Merial Limited), where he worked to gain licensure of the coated sachet raccoon rabies vaccine delivery system. He also worked on the Bacterial Process Development team at Merial, where his focus was the development of bacterial processes for large-scale vaccine production for cattle, swine, and dogs. Now that he is back with SCWDS, John's primary duties will involve SCWDS research on *Culicoides*, spp., the vectors of bluetongue and epizootic hemorrhagic disease. We are glad to have him back and look forward to working with him again.

We are glad to welcome Joe Slusher as a new Research Technician III. Joe worked at SCWDS for more than 1 ½ years as a student worker while pursuing his BS degree at the University of Georgia's D.B. Warnell School of Forestry and Natural Resources. He started working for us full-time when he completed his degree in May 2009. Joe is a "jack-of-all-trades" and works wherever he is needed. At present, he is assisting with the field work for deer herd health evaluations, conducting field surveillance for the *Culicoides* research, and doing some of the technical laboratory work on the chronic wasting disease project. We are proud to have Joe with us.

On a less happy note for us, but good news for Dr. John Bryan, we must announce that he is leaving us August 31, 2009, to accept a job as Veterinary Medical Officer with the National Park Service in Fort Collins, Colorado. John graduated from The University of Georgia's College of Veterinary Medicine in May 2007 and

came to work at SCWDS on August 1. While here, he completed his M.S. degree in veterinary pathology, worked as a diagnostician, and coordinated our CWD testing service. John is a delightful guy to work with, and we are sorry to see him leave, but we wish him much success and happiness in his new job. (Prepared by Gary Doster)

NWHC Has New Director

Officials with the U.S. Department of the Interior's U.S. Geological Survey (USGS) recently announced that Dr. Jonathan M. Sleeman has been selected to be Director of the National Wildlife Health Center (NWHC), headquartered in Madison, Wisconsin.

Jonathan has had an interesting and varied career and is highly regarded in the fields of wildlife and ecosystem health and wildlife conservation, and is well qualified for his new duties. In speaking of Dr. Sleeman's appointment, Suzette Kimball, acting director of the USGS, stated, "Dr. Sleeman joins the USGS with a solid reputation in the wildlife health community for his expertise in disease and wildlife conservation medicine. His expertise and passion for the field of wildlife health and disease will be an asset to our nationally recognized programs at the National Wildlife Health Center."

A native of England, Jonathan earned degrees in zoology and veterinary medicine with honors and distinction from the University of Cambridge. He completed a residency in zoological medicine at the College of Veterinary Medicine at the University of Tennessee in 1995. From 1995 to 1997, he was the Field Director of the Mountain Gorilla Veterinary Center in Rwanda. He returned to the United States in 1997 and worked as an instructor in zoological medicine at Colorado State University but continued health studies with mountain gorillas and chimpanzees in central Africa.

From 2001 to 2005, Jonathan served as Director of Veterinary Services at the Wildlife Center of Virginia (WCV), a private veterinary hospital for native wildlife. During part of this time, he concomitantly served as Adjunct Professor at the Virginia-Maryland Regional College of Veterinary Medicine and as Adjunct Assistant Professor at the College of Veterinary Medicine at the

University of Tennessee. During his time at WCV, Jonathan led several research projects on a variety of wildlife health and diagnostic topics.

From 2005 until he accepted his new job with the NWHC, Jonathan was a wildlife veterinarian with the Virginia Department of Game and Inland Fisheries. In this position, we had a great deal of regular contact and interaction with Jonathan, and it was a pleasure to work with him.

Jonathan has published extensively. Some of his better-known works include "Conservation Medicine Approach to Managing Wildlife Diseases," "Wildlife Zoonoses with an Emphasis on Bioterrorism Agents," "Wildlife Rehabilitation Centers as Monitors of Ecosystem Health," and "Great Ape Anesthesia."

Throughout his diverse career, Jonathan has achieved a high level of success in service and research. SCWDS has had an excellent working relationship with Dr. Sleeman for many years, and we know that it will be a pleasure to continue working with him in his new position. We congratulate and commend him on his new job. (Prepared by Gary Doster with additional information from a news release from the Office of Communications of the USGS)

New USDI Publication on Bats

The U.S. Geological Survey, National Wildlife Health Center, recently published USGS Circular 1329, *Bat Rabies and Other Lyssavirus Infections* by Denny G. Constantine. Major funding support for this publication was provided by the U.S. Fish and Wildlife Service, Division of Federal Assistance, Administrative Grant AP95-017. Comments on the report are encouraged and should be sent to the above address.

This highly illustrated publication expounds on the globally distributed bat lyssaviruses, with a strong emphasis on bat ecology. Information is presented in a nontechnical format useful for a broad audience with varying levels of biological knowledge. Bat rabies is a zoonotic disease (transmissible between animals and humans) caused by viruses of the genus *Lyssavirus*. Bats are an important component of the ecology of lyssaviruses, including their maintenance and transmission. Extensive geographic information

and a world history of bat rabies also are included in this report.

General access to USGS Circular 1329, *Bat Rabies and Other Lyssavirus Infections* is available via the USGS' Publications Warehouse website, <http://pubs.er.usgs.gov/>. This publication is available in print and on compact disc (CD) from the U.S. Geological Survey, Branch of Information Services at 1-888-ASK-USGS (275-8747). CDs and a PDF version of this report, as well as other USGS publications and information, also are available on the internet at <http://www.nwhc.usgs.gov/>. (From a news release prepared by Jonathan Sleeman, National Wildlife Health Center)

Recent SCWDS Publications Available

Below are some recent publications authored or co-authored by SCWDS staff. Many of these can be accessed online from the web pages of the various journals. If you do not have access to this service and would like to have a copy of any of these papers, let us know. Many can be sent to you electronically with minimum effort; others will be mailed to you. For your convenience, please indicate requested publications, fill out the form on page 9, and check the appropriate box to receive either an electronic copy or a hard copy and return it to us: Southeastern Cooperative Wildlife Study, College of Veterinary Medicine, University of Georgia, Athens, GA 30602.

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