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SCWDS BRIEFS

A Quarterly Newsletter from the

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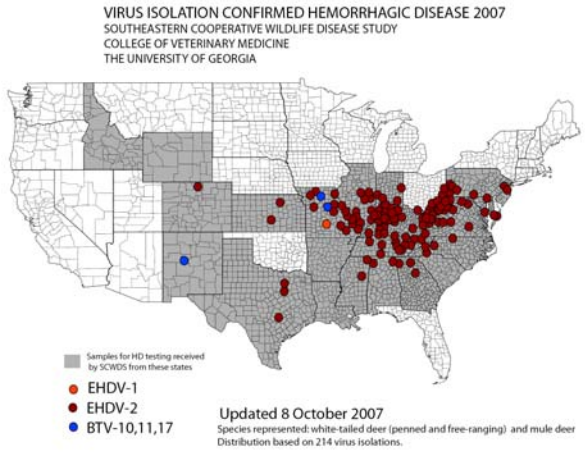
Hemorrhagic Disease in 2007

SCWDS has received an unprecedented number of blood and tissue samples from penned and wild white-tailed deer this year for virus isolation for hemorrhagic disease (HD). As of October 16, 2007, we had made 237 virus isolations. This number also is unprecedented, and SCWDS continues to receive large numbers of samples, as well as telephone reports and inquiries every day. Nearly all virus isolations have been epizootic hemorrhagic disease virus-serotype 2 (EHDV-2) from white-tailed deer, although EHDV-1 and bluetongue virus (BTV)-10, -11, and -17 viruses were isolated from deer in Missouri, and BTV-17 was isolated from a mule deer in New Mexico and three pronghorns in Wyoming. The current distribution of isolates is presented in Map A below, and a distribution map that is updated regularly can be seen at the SCWDS website (www.scwds.org).

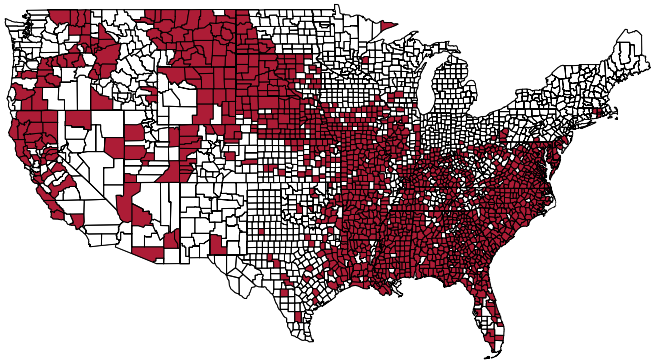


Map A

Hemorrhagic disease occurs annually in the United States, and most outbreaks in white-tailed deer are caused by EHDV-2. There is no reason to assume that the current outbreak is associated with a particularly virulent strain. EHDV-2 can cause high mortality rates, especially when deer are infected in the northern United States where the deer are not regularly exposed to the virus and, hence, are more susceptible to disease when the virus is encountered. There are two aspects of this outbreak that have sparked speculation and discussion. The first involves a potential expansion of the traditional HD range due to climate change, and the second involves clinical disease in cattle.

The historic distribution of HD as compiled from reports of clinical disease from 1980-2003 shown in Map B below includes much of the United States. The map does not represent the entire distribution of HD viruses, because infections in white-tailed deer in some areas, such as portions of Texas and Florida, often are subclinical. Based on the historic distribution, it appears that the current outbreak falls primarily within the historic range of HD, although some expansion may be occurring.

Hemorrhagic Disease in Deer during 1980-2003



Map B

Although it is premature to suggest that the 2007 activity is a product of global climate change, we cannot ignore the fact that the southeastern United States is in the midst of a severe drought and that the initial cases this year were spatially associated with areas of especially severe drought in Kentucky and Tennessee. Whether

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the current drought is a result of climate change is an issue yet to be determined. The drought/HD relationship is not new and has been suggested since the 1980s. We currently are analyzing historic data from our records to better understand this potential relationship.

Epizootic hemorrhagic disease is not a recognized disease of cattle, but it is well known that they can be infected. There are two contrasting observations that cause confusion related to the issue of clinical disease in cattle. First, as is occurring this year, suspected cattle disease associated with EHDV-2 infection is a common occurrence during large-scale EHDV epizootics. Such reports occur routinely when the virus is causing extensive deer mortality in the northern United States. In most clinical cases, cattle show mild disease, but occasional reports of abortion and even death (both unconfirmed) do occur. Unfortunately, "suspected" cattle cases are seldom confirmed, and it must be understood that the presence of antibodies in such animals does not confirm EHDV as a cause of morbidity or mortality. On several occasions, including once this year, we have isolated EHDV-2 from a cow with bluetongue-like disease, but even this may not confirm that the virus was the cause of the disease.

Secondly, clinical disease never has been associated with experimental EHDV infections of cattle, including one SCWDS study (Abdy et al. 1999. Experimental infection of calves with epizootic hemorrhagic disease virus. *American Journal of Veterinary Research* 60: 621-626). The truth likely lies somewhere between the field observations and the results of these experimental studies. The following hypothesis fits with the limited data available: The reported disease in the field is similar to bluetongue, and it is reasonable to speculate that EHDV would cause similar signs and lesions. With BTV infections, clinical disease in cattle is not common and is mild when it occurs. If EHDV causes mild disease in a small proportion of those cattle infected, it may be that the disease would not be detected in the small number of animals in experimental studies and would be detected in the field only under exceptional challenge conditions, as are occurring now. If this hypothesis is correct, EHDV would be of minor concern to cattle producers but could be responsible for sporadic disease in certain areas of the United States. All reports received at SCWDS concerning suspected disease in cattle have been associated with the northern edge of the HD range (as defined by reported disease in white-tailed deer), and it is possible that such potential problem areas could be defined by vector distribution and herd immunity.

The reports of suspected EHD in cattle and confirmed HD in wild and penned deer can result in each group of producers/managers blaming the other for their problems. Cattle, wild deer, and penned deer, in fact nearly all ungulates, can be infected with EHDV, can be involved in viral amplification, and can serve as a source of virus to vectors, but it is not these animals that represent the reservoir for these viruses. In reality, the population dynamics of the midge vector, *Culicoides sonorensis,* may be the most important factor in these outbreak situations. (Prepared by Dave Stallknecht)

Gone with the Pigs? VS on Ossabaw Island

Vesicular stomatitis (VS), caused by antigenically related but distinct viruses of the genus *Vesiculovirus*, family Rhabdoviridae, is extremely important to animal health authorities because it causes disease in cattle, swine, and other cloven-hoofed animals, and, in addition, the clinical signs mimic those of foot-and-mouth disease, one of the most devastating and feared diseases of livestock. VS epidemics have been reported in livestock in the western United States as recently as 2006 (see SCWDS Briefs Vol. 22, No. 3). Large VS epidemics have occurred in the eastern United States, but none have been reported since the late 1970s.

The only known endemic focus of VS in the United States is on Ossabaw Island, a barrier island off the coast of Georgia. Here, the New Jersey strain of VS virus (VSNJV) initially was detected by SCWDS in the 1960s through serologic testing of feral swine and white-tailed deer. Intensive studies conducted by SCWDS during the 1980s determined that VSNJV was maintained on the island in a transmission cycle involving sand flies and feral swine. SCWDS has tested blood samples from hunter-killed white-tailed deer on Ossabaw annually since 1981 as a

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means of monitoring VSNJV transmission (see SCWDS Briefs Vol. 17, No. 1). These data indicate that the prevalence of antibodies to VSNJV in white-tailed deer is highly variable from year-to-year and that the prevalence decreased significantly over time and reached undetectable levels from 2003 to 2005. In 2005, SCWDS recruited a graduate student to investigate a possible explanation for the apparent disappearance of VSVNJ from Ossabaw Island.

From 2005 to 2006, over 4,000 sand flies were collected for virus isolation at Ossabaw Island sites that were sampled in the 1980s, when the endemic cycle was characterized. Analysis was conducted on gut contents of females after they had fed to determine if sand fly feeding preference had changed over time. Additionally, serum samples from a variety of wild animals, including armadillos, opossums, raccoons, feral swine, and white-tailed deer were tested for the presence of VSNJV neutralizing antibodies. Virus isolations on sand fly samples were negative, and, for a fourth consecutive year, VSNJV neutralizing antibodies were not detected in serum samples from any of the animals tested.

Bloodmeal analysis indicated that 97% of the blooded sand flies fed on white-tailed deer and 3% fed on feral swine. This is in contrast to 1994, when 81% of sand flies fed on white-tailed deer and 16.2% fed on feral swine. The obvious conclusion is that fewer sand flies are feeding on feral swine today compared to 1994. But why? One explanation is that feral swine numbers have been reduced to the point that there are fewer opportunities for the sand flies to feed on them. In 1997, the Georgia Department of Natural Resources began a pig reduction program on Ossabaw Island, and by the end of 2006, more than 14,640 feral swine had been removed. Our hypothesis is that the reduction in the feral swine population led to the apparent disappearance of VSNJV on Ossabaw Island. This is supported by the observation that feral swine are the only mammals on the island ever documented with clinical VS and they are amplifying hosts for VSNJV. We recognize that "absence of proof is not proof of absence" and we will continue to hunt for VSNJV on Ossabaw Island. (Prepared by Danny Mead)

Theileriosis in Alabama Reindeer

In mid-August 2007, three reindeer died on a private game farm in north-central Alabama. The owner attributed the deaths to excessive heat, but within a week another 11 reindeer died. Necropsies of these reindeer and examination of blood smears identified acute piroplasmosis as the cause of death. Clinical signs were not observed until a few hours before death and consisted of incoordination and lethargy. The remaining nine reindeer were treated with an acaracide, imidocarb; however, three additional reindeer died the week after the first dose, and a fourth reindeer died after the second dose. Blood smear analysis of the treated reindeer revealed fewer intraerythrocytic organisms compared with the initial samples from untreated reindeer. During the one-month period, 18 of 23 (78%) reindeer on the farm died.

Piroplasms are intraerythrocytic protozoans belonging to the genera *Babesia*, *Theileria,* and *Cytauxzoon*. Piroplasmoses are common infections of free-living animals world-wide. Many piroplasms are important pathogens of domestic animals and humans, and in recent years an increasing number of them have been documented in hosts other than their presumed primary host, often with fatal results.

Babesia odocoilei and a *Theileria* sp. (erroneously called *T. cervi* in the past) are natural parasites of white-tailed deer (WTD) in the United States. Natural infections with *B. odocoilei* have been reported in a variety of cervids (farmed elk and reindeer/caribou in the United States and free-ranging American woodland caribou in Canada) and bovids (desert bighorn sheep, musk oxen). Although infections in WTD often are benign, heavy infections can result in hemolytic anemia and anorexia. Infections in elk often result in acute fatal babesiosis, but serologic studies indicate that some elk survive infections. In contrast, all known infections in reindeer/caribou have been fatal. The WTD *Theileria* sp. has been reported from naturally infected elk, and morphologically similar parasites have been found in mule deer and exotic cervids in Texas. Clinical disease associated with the *Theileria* sp. in WTD is rare but has been reported in heavily infected fawns.

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Both of these parasites are tick-transmitted. The vector of *B. odocoilei* is the black-legged tick, *Ixodes scapularis*, and the vector of the *Theileria* sp. is the lone star tick, *Amblyomma americanum*. The black-legged tick is far more common in the northeastern and midwestern United States but can be found throughout the Southeast. The lone star tick is the most common tick in the Southeast and Midwest but is rapidly expanding its range into the Northeast. Accordingly, *B. odocoilei* has been reported in either mammalian hosts or ticks in several northern tier states (Indiana, Maine, Minnesota, Massachusetts, New Hampshire, New York, Pennsylvania, and Wisconsin) and fewer southern states (Oklahoma, Texas, and Virginia). Interestingly, it also has been reported in California. The WTD *Theileria* sp. has been reported from infected lone star ticks, white-tailed deer, and elk from numerous southeastern states.

Blood samples from the affected reindeer in Alabama were submitted to SCWDS for molecular identification of the causative agent. Sequence and restriction enzyme analysis of the partial 18S rRNA gene of the piroplasm from blood samples from 10 reindeer identified the culprit to be the WTD *Theileria* sp. The spatial and temporal aspects of the outbreak also agree with *Theileria* infection, because the lone star tick is more common in the southern states and is more active during late summer. Although some of the reindeer had been imported from northern states, several of the infected animals were born in Alabama, indicating that transmission was occurring on the Alabama farm. Tick control around the premises was recommended to prevent future transmission and animal losses. This represents the first report of the WTD *Theileria* sp. as a cause of mortality in reindeer. (Prepared by Michael J. Yabsley and Misty Edmonson [Auburn University])

Cryptosporidium in Wildlife

Results of a recent molecular study of *Cryptosporidium* spp. in New York indicated that wildlife is unlikely to be a significant factor in the epidemiology of human cryptosporidiosis in the area. Results of the investigation of *Cryptosporidium* spp. in free-ranging wildlife in the New York City watershed were published by Feng et al. in the October 2007 issue of Applied and Environmental Microbiology (pp. 6475-6483). The study found that wild animals contribute to *Cryptosporidium* spp. contamination of surface water, but do not appear to have major public health significance.

Cryptosporidium spp. infect numerous animal species, including humans. The protozoal parasites are transmitted by the fecal-oral route, and oocysts are infectious immediately upon excretion. The infectious dose is low, and oocysts are resistant to standard chlorine disinfection. The organisms infect the gastrointestinal, biliary, and respiratory tracts of humans and more than 45 other vertebrate species. The major symptom of human cryptosporidiosis is diarrhea, and this also is seen in domestic animals, notably young calves and lambs. In persons with intact immune systems, infection may be asymptomatic or cause self-limiting intestinal illness. However, immunodeficient people, especially AIDS patients, may be unable to clear the parasite, and the disease has a protracted and fulminant clinical course contributing to death.

Human infections most frequently result from consumption of contaminated water. In the largest recorded outbreak in the United States, a cryptosporidiosis epidemic in 1993 in Milwaukee, Wisconsin, sickened approximately 400,000 people and was attributed to contamination of the municipal water supply due to a malfunction of a water treatment plant. Cryptosporidiosis also has emerged as the most frequent cause of recreational water-associated outbreaks of gastroenteritis. Recreational water is water from swimming pools, fountains, and lakes, and water from rivers, springs, ponds, or streams used recreationally by humans and that can be contaminated with sewage or feces from humans or animals. During 2005, a total of 8,269 cases were reported in the United States, representing a 111% increase over 2004. The doubling primarily was due to a single large outbreak at a recreational water park in New York. The U.S. Centers for Disease Control and Prevention recently recommended improved disinfection technologies to inactivate *Cryptosporidium* oocysts, as well as public education programs for patrons of water recreation venues to share responsibility for controlling the spread of the disease.

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The recent New York study was conducted to identify the animal sources of *Cryptosporidium* spp. contaminating the watershed and to determine if *Cryptosporidium* genotypes from wildlife are associated with human disease. A total of 541 wild animals representing 38 species of mammals, birds, amphibians, and fish were examined for *Cryptosporidium* spp. infection using polymerase chain reaction (PCR). Of the animals examined, 21% were positive, with 91% of the positive samples originating from mammals. Among mammals, rodents had the highest prevalence (33%), with most infections in deer mice and members of the squirrel family. Five of 59 (8.5%) white-tailed deer and 10 (19.2%) Canada geese were positive. *Cryptosporidium* was not detected in any other avian species, or in 55 fish examined.

In this study, 21 distinct *Cryptosporidium* genotypes were identified by genetic analysis, and some individual animals were infected simultaneously with multiple genotypes. The study supports previous investigations that concluded that most *Cryptosporidium* spp. from wildlife are host adapted in nature: most genotypes were found in a few related animals, such as mouse genotypes in deer mice, a deer genotype in deer, a vole genotype in voles and chipmunks, and goose genotypes in Canada geese. The results also support host adaptation and parasite-host coevolution of *Cryptosporidium* spp., because some related host species had related *Cryptosporidium* genotypes; however, the host specificity is not strict. For example, in this study, the cervine *Cryptosporidium* genotype was found in raccoons and five rodent species, and previously has been found in humans, lemurs, and various ruminants. The authors concluded that the "generalist nature of the host specificity of the parasite and habitat sharing are probably responsible for the wide occurrence of the cervine genotype in animals."

Five of the 21 genotypes identified in this study have been found previously in humans. Of these five genotypes, only two (cervine and chipmunk I) were reported in more than one animal in the study. The cervine genotype was seen in many animals in this study and in storm water. This *Cryptospordium* genotype has been found in only a few human cases worldwide, and chipmunk genotype I has been reported only in two persons in Wisconsin. These findings led the authors to conclude that "wildlife is unlikely to be a major contributor of human pathogenic *Cryptosporidium* sp. in the source water." Additional information on cryptosporidiosis can be found at www.cdc.gov. (Prepared by Rick Gerhold)

TWS Addresses Baiting and Feeding of Wildlife

The Wildlife Society (TWS) recently published a Technical Review and a Final TWS Position Statement on baiting and supplemental feeding of game species. The Technical Review process included a complete review of relevant literature by a group of experts who then summarized the positive and negative aspects of baiting and feeding for black bears, cervids and other hoofed animals, and migratory and upland game birds. For each wildlife category, the Technical Review addresses relevant issues including history and economics, behavioral and physiological impacts, role in the spread of diseases and parasites, and potential impacts on wildlife management, ecological integrity, and public health and safety. An additional section focuses on social, political, and legal issues of wildlife baiting and feeding.

Baiting and supplemental feeding of game species are clearly defined in the Technical Review and Final Position Statement and include the intentional placement of food for use by wildlife for enhancement of hunter harvest or viewing opportunities, capturing wildlife for research and management programs, disease control, supplementing wildlife food supplies under emergency conditions, and attempting to improve the condition of individual animals by increasing weight, growth rates, and/or antler size. Wildlife openings and food plots that are planted according to standard local agricultural practices were not included in definitions of baiting or feeding.

The Wildlife Society did not develop a uniform baiting and feeding policy for adoption by all federal, state, and provincial wildlife management agencies in North America because of regional differences in game species management needs and traditional hunting and trapping practices. However, TWS encourages careful examination

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of the short and long-term biological, social, and economic impacts of baiting and feeding because these practices often are detrimental to wildlife resources.

The policy of TWS regarding baiting and supplemental feeding of game species is to:

- Encourage agencies to inform and educate the public, resource managers, administrators, and policy-makers about potential consequences of baiting and feeding
- Encourage federal, state, and academic institutions to intensify investigations of the full spectrum of wildlife species affected by baiting and feeding
- Where appropriate, encourage replacement of existing baiting and feeding with habitat conservation and management practices to improve food resources and habitat productivity
- Encourage studies to determine actual spread of pathogens between domestic and wild migratory and upland game birds that are baited or fed in common areas
- Encourage examination of physiological impacts on bears and other wildlife commonly using bait and feed sites intended for ungulates, and investigate potential for disease transmission among and between bears, ungulates, and other wildlife species at these sites
- Encourage the Association of Fish and Wildlife Agencies and all federal, state, and provincial wildlife agencies to cooperate in reviewing and revising their baiting and feeding policies to ensure they address all costs and benefits to wildlife conservation
- Encourage research on the impacts of baiting and feeding on game species home range size, fecundity, behavior, habituation to people, harvest, and disease transmission in all affected species
- Expand educational efforts to emphasize the importance of habitat conservation and management as the primary conservation approach for wildlife species, biological diversity, and habitats
- Advocate that strengthened authority be granted to federal, state, and provincial fish and wildlife agencies to regulate baiting and feeding
- Encourage fish and wildlife agencies, wherever possible, to phase out supplemental feeding of wild ungulate populations, both in-house and by the general public, and to manage populations at levels that are compatible with the long-term carrying capacity of the habitat.

The TWS Final Position Statement can be found at www.tws.org, and the Technical Review can be ordered by TWS members and non-members at the same website. (Prepared by John Fischer)

SCWDS Awards at WDA Meeting

We were very pleased that Randy Davidson received the Wildlife Disease Association's (WDA) 2007 Emeritus Award at the 56th annual meeting of the Association held in Estes Park, Colorado, August 12-17. This is "an honorary category of membership awarded by the Council to members of the WDA who have retired from their profession and who in the opinion of Council have contributed significantly to the study of wildlife diseases." The award is given to one individual each year at the association's annual meeting. Two other SCWDS affiliates have received this honor since it was created in 1969 – Dr. Frank Hayes in 1988 and Dr. Vic Nettles in 2001.

Randy previously was honored by the WDA in 1998 when he received the Distinguished Service Award (DSA) from the Association. The DSA is the highest award of the WDA and is given to "honor a WDA member of long standing who, by his/her outstanding accomplishments in research, teaching and other activities, including participation in WDA affairs, has made a noteworthy contribution furthering the aims of the Wildlife Disease Association." Previous SCWDS recipients of this award were Dr. Katherine Prestwood in 1988 and Dr. Vic Nettles in 1995.

Randy retired from SCWDS in November 2005 after an extremely productive 30-year career. For a comprehensive review of some of Randy's many achievements and honors, see the October 2005 issue of the *SCWDS BRIEFS* (Vol. 21, No. 3). However, as stated in that article, "It would require an entire issue of the *SCWDS BRIEFS* to list all of Randy's accomplishments and contributions to his profession, his colleagues, and his graduate students…" Suffice it to say he

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did a lot and we were fortunate to have had him here.

Two of our present graduate students also were recognized at this year's meeting for their quality work on wildlife diseases. Dr. Justin Brown received honorable mention in the WDA's Terry Amundson Student Presentation Competition for his presentation entitled "Comparative susceptibility of waterfowl and gulls to highly pathogenic avian influenza H5N1 virus." Dr. Rick Gerhold received honorable mention in the WDA's Graduate Student Research Recognition Award for his research entitled "Identification of cryptic species in the *Trichomonas gallinae* morphological complex by molecular characterization." We are proud of Justin and Rick and congratulate them for their achievements. (Prepared by Gary Doster)

SCWDS Anniversary Honored

This is the last in a series of articles commemorating the founding of SCWDS on July 1, 1957. Several state, national, and international fish and wildlife management agencies and conservation organizations have honored SCWDS during our 50th anniversary. Organizations providing special recognition for SCWDS include Ducks Unlimited, the National Wild Turkey Federation, Quail Unlimited, and the Quality Deer Management Association. Nearly all SCWDS member states have published articles in their conservation magazines describing SCWDS and our accomplishments over our first 50 years. And special resolutions honoring SCWDS were adopted by the Southeastern Association of Fish and Wildlife Agencies, the organization that founded SCWDS, as well as the Association of Fish and Wildlife Agencies (AFWA) that includes all 50 state wildlife conservation agencies in its membership. (The AFWA Resolution can be found below.)

We recognize that the honors we have received this year are offered not only to current SCWDS personnel, but also to all of the fine people who have worked at SCWDS since 1957. It has been very satisfying and humbling to receive such recognition. However, we believe that our greatest honor at SCWDS is the confidence you place in us by providing the opportunity to work with you in the management and conservation of our cherished wildlife resources. We look forward to the next 50 years.

AFWA Resolution 2007-1

Whereas, the Southeastern Cooperative Wildlife Disease Study (SCWDS) was founded in 1957 by the Southeastern Association of Fish and Wildlife Agencies as the first regional diagnostic and research center created specifically for the investigation of diseases in wildlife; and

the novel, collaborative, multi-state structure of SCWDS has consistently provided exemplary service, ranging from the investigation of wildlife morbidity and mortality events to expert testimony in legislative and judicial proceedings on issues often of a highly public and controversial nature; and

SCWDS has conducted scientifically sound research on diseases and parasites of wildlife; and

SCWDS has provided wildlife health workshops and other in-depth training for wildlife managers and other employees with state, federal, and non-governmental wildlife management organizations throughout the Southeast and the nation; and

SCWDS places a high value on education, as witnessed by the early establishment of a graduate degree program, whereby since 1964, SCWDS graduate students have earned 39 M.S. degrees and 24 PhD degrees; and

additional SCWDS efforts in education have included instruction of graduate level courses on wildlife diseases for more than 40 years to hundreds of wildlife and veterinary students, many of whom have been employed by state and federal wildlife agencies and have held key leadership positions throughout the country; and

SCWDS has published the books *Diseases and Parasites of White-tailed Deer* and *Field Manual of Wildlife Diseases in the Southeastern United States*, and SCWDS staff members have authored more than 450 articles in scientific journals and symposia proceedings, as well as numerous book chapters and popular articles on disease issues affecting wildlife; and

SCWDS is highly regarded regionally, nationally, and internationally for its expertise in wildlife

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SCWDS BRIEFS

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health issues and disease interactions between wildlife, domestic animals, and humans; and

SCWDS has consistently promoted management of wildlife health issues as an essential component of the North American Model for Fish and Wildlife Conservation; and

SCWDS represents a highly successful and enviable cooperative effort of the members of the Southeastern Association of Fish and Wildlife agencies;

Therefore, be it resolved that the Association of Fish and Wildlife Agencies recognizes SCWDS for 50 years of exemplary service to wildlife managers, researchers, and administrators and commends SCWDS for its accomplishments, availability, professionalism, commitment, and friendship.

Information presented in this newsletter is not intended for citation as scientific literature. Please contact the Southeastern Cooperative Wildlife Disease Study if citable information is needed.

Information on SCWDS and recent back issues of the *SCWDS BRIEFS* can be accessed on the internet at www.scwds.org. The BRIEFS are posted on the web site at least 10 days before copies are available via snail mail. If you prefer to read the BRIEFS online, just send an email to Gary Doster (gdoster@vet.uga.edu) or Michael Yabsley (myabsley@uga.edu) and you will be informed each quarter when the latest issue is available.