REPORT OF THE COMMITTEE ON WILDLIFE DISEASES

Chair: John Fischer, GA
Vice Chair: Colin Gillin, OR

Wilbur Amand, PA; Gary Anderson, KS; Neil Anderson, MT; Paul Anderson, MN; Joan Arnoldi, WI; Karen Beck, NC; Scott Bender, AZ; Warren Bluntzer, TX; Kristina Brunjes, KY; Beth Carlson, ND; Walter Cook, WY; Joseph Corn, GA; Thomas DeLiberto, CO; Mark Drew, ID; James Evermann, WA; Richard French, NH; Francis Galey, WY; Robert Gerlach, AK; Paul Gibbs, FL; Linda Glaser, MN; Greg Hawkins, TX; Kristi Henderson, IL; Terry Hensley, TX; Linda Hickam, MO; Donald Hoenig, ME; David Hunter, MT; Mandy Kauffman, WY; Kevin Keel, CA; Susan Keller, ND; Patrice Klein, MD; Terry Kreeger, WY; Jim Logan, WY; Francine Lord, CAN; Margie Lyness, GA; David Marshall, NC; Chuck Massengill, MO; Gregory Mayr, NY; Leslie McFarlane, UT; Daniel Mead, GA; Robert Meyer, WY; Michele Miller, FL; Eric Mohlman, NE; Mitchell Palmer, IA; Jewell Plumley, WV; Jennifer Ramsey, MT; Justin Roach, OK; Mark Ruder, KS; Emi Saito, CO; Shawn Schafer, ND; David Schmitt, IA; Dennis Schmitt, MO; Stephen Schmitt, MI; Brant Schumaker, WY; Charly Seale, TX; Laurie Seale, WI; Daryl Simon, MN; Jonathan Sleeman, WI; David Stallknecht, GA; Cleve Tedford, TN; Robert Temple, OH; Charles Thoen, IA; Lee Ann Thomas, MD; Brad Thurston, IN; Kurt VerCauteren, CO; Diana Whipple, IA; Ellen Wiedner, FL; Margaret Wild, CO; Richard Willer, HI; Ellen Mary Wilson, CA; David Winters, TX; Richard Winters, Jr., TX; Cindy Wolf, MN; Peregrine Wolff, NV; Mary Wood, WY; Marty Zaluski, MT.

The Committee on Wildlife Diseases met on October 20, 2013 at the Town and Country Hotel, San Diego, California, from 12:30 – 5 pm. There were 89 persons attending; 31 members and 58 guests. The Chair and Co-Chair welcomed those in attendance and reviewed the agenda.

USAHA/AAWV Travel Scholarships

Vice Chair, Dr. Colin Gillin of the Oregon Department of Fish and Wildlife, introduced two students who received travel scholarships from USAHA and the American Association of Wildlife Veterinarians to attend the annual USAHA meeting. Charles Alex is a veterinary student at Virginia-Maryland, Dr. Katie Haman is a PhD candidate in an NIH-funded project in British Columbia. Both students informed the committee regarding their backgrounds, career plans, and their interest in USAHA.

Serology as a Diagnostic Tool for Avian Influenza Surveillance in Wild Birds

Dr. Justin Brown of the Southeastern Cooperative Wildlife Disease Study (SCWDS) updated the committee on potential uses of serology for avian influenza virus (AIV) surveillance in wild birds.

Surveillance for Avian Influenza Virus (AIV) in wild birds historically has relied on virus isolation and/or reverse transcriptase polymerase chain reaction (RT-PCR) to detect AIV shedding in oral or cloacal swabs. Serology has been underutilized in wild bird AIV surveillance, because many of the assays routinely used for antibody detection in domestic galliforms (e.g. agar-gel immunodiffusion test) perform poorly in important wild bird hosts for AIV, including waterfowl. The development of species-independent commercial blocking enzyme-linked immunosorbent assays (bELISA) provided a diagnostic tool that reliably detects type-specific antibodies to AIV in a wide-diversity of avian species. Consequently, over the recent years, serologic testing, using the bELISA, has been increasingly incorporated into wild bird AIV surveillance efforts. As a compliment to virus isolation and RT-PCR, type-specific serologic data have provided a wealth of valuable information on viral exposure in wild birds, which has improved our ability to interpret virus isolation/RT-PCR-based data, expanded our understanding on AIV epidemiology in wild birds, and guided future surveillance efforts. Although valuable, type-specific serologic data have provided very limited information on population immunity.

Subtype-specific serologic tests are necessary to begin to address the dearth of information on AIV immunity within wild bird populations. Historically, however, subtype-specific serologic assays, such as the hemagglutination inhibition (HI) and virus neutralization (VN) tests have only been used sporadically in wild birds to screen for exposure to specific AIV subtypes on the population level. There are many challenges associated with using subtype-specific serologic assays in wild birds, including a lack of understanding on the duration of the detectable antibody response or how the measurable antibody response relates to protective immunity, the potential for cross reactions between related HA or neuraminidase (NA) antigens, a lack of understanding on the effects of repeated infections with multiple

subtypes, and the demand for high serum volumes to test for multiple subtypes. In order to begin to address these issues, we have developed a VN assay that tests for antibodies directed against HA1-12 and requires a relatively low volume of serum. We are currently validating this assay on field and experimental serum samples in multiple wild avian species. Preliminary results indicate that this test has good sensitivity and specificity; however, as expected, there is some evidence of cross reactions between matched NA antigens. Validation results, as well as preliminary field trials with this assay, are promising and suggest there may be valuable applications for field and experimental research on AIV in wild birds. Such research will provide insights into population immunity to AIV in wild bird populations and begin to address basic questions related to the role of immunity in subtype diversity and risks for introduction of new viruses into wild bird populations (e.g. H5N1 highly pathogenic avian influenza virus).

The National Feral Swine Mapping System

Dr. Joseph Corn, Southeastern Cooperative Wildlife Disease Study (SCWDS), University of Georgia, provided an update on the National Feral Swine Mapping System (NFSMS). SCWDS began producing nationwide feral swine distribution maps in 1982 by working directly with state and territorial natural resources agency personnel. In 1982, 17 states reported feral swine in a total of 475 counties. With support from USDA-APHIS-Veterinary Services (VS), SCWDS developed and implemented the National Feral Swine Mapping System (NFSMS) in 2008. The NFSMS is an interactive data collection system used to collect and display current data on the distribution of feral swine in the United States. The feral swine distribution maps are produced using data collected from state and territorial natural resources agencies, USDA-APHIS-Wildlife Services (WS), and other state/federal wildlife and agriculture agencies. The map is available to be viewed by the public on the NFSMS home page. Distribution data submitted by agency personnel are evaluated by SCWDS on a continual basis, and the distribution map is updated with verified additions on a monthly basis. Feral swine populations and/or sightings are designated either as established breeding populations, or as sightings, but only established breeding populations are included on the map and in the total of the number of states with feral swine. Over 600 additions have been made to the feral swine distribution map through the NFSMS since January 2008. Additional data are provided to state/federal agencies and universities on request. Although the distribution of feral swine continues to increase in the United States, feral swine were recently eliminated from Nebraska. Established feral swine populations were reported in 37 states in 2011, but currently in 2013 are reported as present in 36 states. The NFSMS is accessed via the internet at http://www.feralswinemap.org/.

Investigation of *Brucella suis* in Dairy Cattle

Dr. Joseph Corn, Southeastern Cooperative Wildlife Disease Study (SCWDS), University of Georgia, on behalf of Dr. Cristopher Young, USDA-APHIS-VS AVIC for Florida and Georgia, who was unable to attend. Dr. Corn reported to the committee that the impact of the growing feral swine population in the United States is creating disease pressure for interspecies infection with *Brucella suis*. Of particular interest is the infection of dairy cattle with *B. suis* and the subsequent risk from raw milk consumption. A Grassroots Project is on-going in Georgia to evaluate and define the interface of feral swine and dairy cattle, to perform targeted brucellosis surveillance, develop a survey instrument to evaluate risk factors for dairy farms, and finally to develop materials for outreach.

Bighorn Sheep Disease Sampling Workshop

Dr. Peregrine L. Wolff of the Nevada Department of Wildlife reported that a bighorn sheep disease sampling workshop was coordinated at the request of Western Association of Fish and Wildlife Agencies, Wildlife Health Committee (WAFWA WHC) in order to standardize diagnostic testing protocols for bacterial pathogens. The rationale for bringing together wildlife health professionals that work on wild sheep included 1) numerous tests are available but there is often confusion on interpretation of results; 2) different laboratories use different methods leading to results that cannot be compared from laboratory to laboratory; and 3) there was a need to review and update the 2009 WAFWA WHC sheep sampling guidelines.

Wildlife Veterinarians and Wildlife Health specialists / Pathologists from eight western states and two Canadian provinces attended, and WAFWA Wild Sheep Working Group members surveyed for input prior to the workshop.

Focus of the workshop was to review tests that are available for major pathogens in Pneumonia Complex in bighorn sheep: *Pasteurella* species (phenotypic culture, bio-typing, MALDI -TOF, 16S, PFGE,

PCR); *Mycoplasma ovipneumoniae* (culture, PCR, ELISA); respiratory viruses (PI3 / BRSV) (virus isolation, serum titers). Specific questions asked included: What do the specific tests tell you? Are the tests available commercially? What is needed for each sheep in each situation?

The workshop participants also discussed standardized descriptions of histologic lesions, development of necropsy protocols (laboratory and field), and identification of specific tests for various situations, such as herd health assessment, pre-trap and transplant, disease/mortality events in populations. Goals and products of this workshop included: developing protocols to implement during the 2013-14 capture season, and in interpreting herd test results, updating the 2009 WAFWA/WHC sheep sampling guidelines, and defining terms (health herd, disease event, die-off, etc.). Follow up reports to this workshop will be presented at Wild Sheep Working Group meeting in Reno, Nevada in 2014, and at the Wild Sheep and Goat Council meeting in Fort Collins, Colorado in 2014. The workshop participants also plan to implement specific disease sampling training for wild sheep managers.

Exotic Lice and Hair-Loss Syndrome in Native Deer of the Western United States

Vice Chair, Dr. Colin Gillin of the Oregon Department of Fish and Wildlife, reported that exotic lice on North American deer have been observed since the 1940's, with recent outbreaks occurring in several western states. Two louse species of Eurasian origin (*Bovicola tibialis* and *Damalinia (Cervicola) forficola*) have infected populations of mule deer (*Odocoileus hemionus hemionus*) and black-tailed deer (*Odocoileus hemionus columbianus*) respectively.

In 1995, black-tailed deer in west-central Washington were observed with a barbered hair loss appearance. The condition spread throughout western Washington, and by 1998 it was observed in Oregon deer populations west of the Cascade Mountains.

Deer with hair-loss syndrome (HLS) often appear emaciated with barbered pelage over regions of the thorax, flanks, and hind-quarters. Deer with this condition engage in excessive grooming and severely affected individuals may become progressively weak and die. Those that have been observed to recover regrow a normal hair coat. Other conditions in affected deer include verminous pneumonia (caused by *Dictyocaulus* spp., *Protostrongylus* sp., etc.), pediculosis (large numbers of chewing lice), peripheral lymphadenopathy (stimulation of the immune system), and high internal parasite burden and diarrhea.

Hair-loss syndrome from *Damalinia* spp. primarily affects black-tailed deer but has not been confirmed in mule deer. The syndrome has not been reported in Roosevelt elk (*Cervus elaphus roosevelti*) occupying similar habitats with affected deer. Research shows lice can live off the host in cool temperatures (40-50 degrees F) up to 2 days and at room temperature up to 7 days. Lice survivability off the host provides another means of indirect transmission in deer resting areas and day beds used by different deer.

Deer in Oregon exhibiting hair loss syndrome show seasonality for the condition with occurrence in winter and spring. Fawns and does between 6-12 months of age are most often affected. HLS west of the Cascades occurs throughout the range of black-tailed deer but less frequently above 600 m elevation. Affected deer are seen in all major habitat types of western Oregon and Washington. There appears to be the potential for localized deer population declines due to HLS with an observed prevalence of 20-80% that may affect winter fawn survival in local populations.

Damalinia spp. infection does not appear to affect livestock or humans. Roosevelt elk in Washington, Oregon, and California have been observed to carry the louse but no hair-loss has been documented. HLS has been observed in Columbia white-tailed deer (*Odocoilius virginianus columbianus*) and the louse has been experimentally transferred from BTD to mule deer, but biologists have not seen the louse in free-ranging mule deer.

Another exotic louse species (*Bovicola tibialis*) has been observed in mule deer and BTD in British Columbia during 1941-54; BTD in Mendocino Co, California 1973; and on fallow and axis Deer in Pt. Reyes California in 1970. More recently this species has been causing similar clinical signs on mule deer as *Damalinia* in Washington (2005), South Dakota (2008), Wyoming, Idaho, California, Nebraska (2009), and Nevada and Oregon (2011).

Cost Benefit Analysis for Reducing Bovine Brucellosis Prevalence in Southern Greater Yellowstone Area Elk

Dr. Brant Schumaker of the University of Wyoming reported to the committee that cattle producers and state wildlife management agencies have undertaken several management strategies to reduce the risk of elk (*Cervus elaphus)*-cattle (*Bos taurus)* brucellosis transmission in the southern greater

Yellowstone area (GYA). However, cases of brucellosis continue to appear in cattle and domestic bison in the GYA, and the wildlife-livestock brucellosis interface has the potential to expand. With decreasing funding available to combat brucellosis, a better understanding of the regional cost-effectiveness of management strategies is necessary. We surveyed cattle producers in the southern GYA to determine where their cattle herds were located and whether producers observed elk overlapping with their cattle during winter months. We used this information to create a resource selection function for elk-cattle overlap. We then used the elk-cattle overlap model as an input to a risk model to estimate the number of years until a cattle case was expected. We modeled three management strategies (Test and Slaughter, Strain 19 vaccination, and low density feeding) to effect varying reductions in elk seroprevalence, thus increasing the number of years until a spillover event was expected. Next, we compared the net change in the annualized cost of a brucellosis case to the annualized cost of the management strategy. For all three management strategies, costs exceeded estimated benefits. If the maximum that society is willing to pay for a management strategy is equal to its expected benefit, none of these three management strategies should be employed. However, if society is willing to pay more for management than its expected benefit, or if the costs of a brucellosis outbreak increase, one or more strategies may be adopted. Based upon our cost-benefit analysis, low-density feeding of elk has the least-negative net benefit and should be the top strategy chosen.

Yellowstone National Park Science Panel on Brucellosis Management Strategies

David E. Hallac, Chief, Yellowstone Center for Resources, National Park Service (NPS), reported that the NPS and Montana Fish, Wildlife, and Parks held a workshop with a group of scientists to review the science surrounding brucellosis in bison and to evaluate disease management strategies, including remote vaccination, contraception, periodic culling, and to provide research ideas. Eight scientists, with a variety of experiences in wildlife management, disease ecology, immunology, and human dimensions of wildlife management, came together for several days in February, 2013 for the discussion. The eight science review panelists authored a report that includes consensus panel conclusions and rationale, research recommendations, panelist bios, abstracts on background scientific publications, and the meeting agenda. The following conclusions were stated:

1. The best available data do not support that vaccination of wild bison with currently available vaccines will be effective at suppressing brucellosis to a level that changes bison management strategies under the Interagency Bison Management Plan.
2. Anticipate that remote vaccination would have behavioral impacts on bison (e.g., reduced tolerance of people, vehicles, etc.).
3. Control of bison population size will likely include culling or removal as tools in the future, along with hunting. Past and current culling practices have not had an apparent effect on reducing the overall prevalence of brucellosis in the bison population.
4. Intervention through contraception is not needed to achieve the current goals of the Interagency Bison Management Plan (IBMP). Contraception could potentially be a valuable tool for brucellosis suppression, but the available data are insufficient to make a judgment at this time.

High priority research ideas included:

1. A Cost/benefit analysis of:
    a. Management options and goals (vaccination, eradication, etc.), and
    b. Producing a more effective vaccine in livestock vs. a more effective vaccine in wild bison or elk.
2. Improve understanding of genetic effects of culling based on seroprevalence
3. Characterize and understand human values and attitudes towards conservation of wildlife affected by brucellosis to improve effective exchange of knowledge for collaborative decision making in the GYA.

The report will be available on the Yellowstone National Park's website at: nps.gov/yell

Chronic Wasting Disease Ecology and Epidemiology of Mule Deer and White-tailed Deer in Wyoming

Dr. Brant Schumaker of the University of Wyoming reported that the effects of high chronic wasting disease (CWD) prevalence in free-ranging deer populations are unknown. In south-central Wyoming, CWD prevalence exceeds 50% in hunter harvested deer. We hypothesized that 1) vital rates are depressed by CWD and the finite rate of population growth (λ) is subsequently lowered, 2) CWD alters

normal deer behavior during preclinical and clinical disease, and 3) genetic differences associated with CWD incubation periods drives natural selection to favor less susceptible deer. To test these hypotheses, we radio-collared white-tailed deer (*Odocoileus virginianus*) and mule deer (*Odocoileus hemionus*) and monitored them to determine a) survival probability, pregnancy rates, and annual recruitment, b) cause of death, c) home range area and habitat use, d) migration patterns, e) dispersal behavior, and f) genetic variation in incubation period based on CWD-status. Deer were tested for CWD using tonsil tissue collected by biopsy at capture and immunohistochemistry. White-tailed deer positive for CWD were 4.5 times more likely to die annually compared to CWD-negative deer. High CWD prevalence depressed survival of young females and resulted in an unsustainable white-tailed deer population ($\lambda < 1.0$); however, when female harvest was eliminated, the population became stable ($\lambda = 1.0$). Female CWD-positive white-tailed deer maintain locally high CWD incidence as they migrated less and occupied smaller home ranges compared to other deer. Male CWD-positive white-tailed deer migrated at the highest proportion and likely contributed to spread of CWD to disparate populations. In the last nine years, mule deer genetically associated with prolonged incubation periods to CWD have increased in frequency in the population. However, it is still unknown whether or not this change will counteract the negative impacts of CWD on the population. The white-tailed deer population is adversely affected by high CWD prevalence; however, implementing management techniques to increase annual survival of females may maintain deer populations. The impact of CWD on mule deer populations is currently unknown; however, the present study is in its final stages with results to be completed in the near future.

A Long Look at Hemorrhagic Disease

Dr. John Fischer, Southeastern Cooperative Wildlife Disease Study (SCWDS), University of Georgia, reported on results of analyses of the occurrence of hemorrhagic disease (HD) of deer in the United States. The analyses were performed by Dr. David Stalknecht, also of SCWDS. Temporal trends in reporting of HD in the Midwest and Northeast United States were investigated using a 33 year (1980-2012) questionnaire-based data set. These data were supported by an additional 19 years (1994-2012) of bluetongue virus (BTV) and epizootic hemorrhagic disease virus (EHDV) isolation results from clinically affected white-tailed deer (*Odocoileus virginianus*) in these regions. The number of counties that were reported positive for HD and the northern latitudinal range of reported HD increased with time. A similar increase was observed with both the number of states annually reporting HD and the number of counties where HD was reported. Excessive reporting, characteristic of large-scale outbreaks that occurred in 1988, 1996, 2007, and 2012, and the scale of these individual outbreaks also increased with time. The predominant virus isolated from these regions was EHDV-2, but the prevalence of EHDV-6, which was first detected in 2006, appears to be increasing. Temporally, the extent of regional HD reporting was correlated with regional drought conditions. The significance of increases in reported HD and the incursions and establishment of new BTV and EHDV in the United States currently are unknown.

There being no resolutions or other committee business, the meeting was adjourned.