

SCWDS BRIEFS

A Quarterly Newsletter from the
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A Closer Look at LPDV

SCWDS has diagnosed lymphoid tumors sporadically in wild turkeys for several years. We suspected these tumors were associated with retroviral infection, as occurs in domestic poultry, but our attempts to identify a causative virus were unsuccessful. However, in 2009, we detected lymphoproliferative disease virus (LPDV), a poorly understood avian retrovirus previously thought to be exotic to North America, in three adult Eastern wild turkeys with lymphoid tumors in multiple organs. Since our initial detections, we have expanded our research and surveillance to better understand LPDV and its epidemiology. Many state and federal wildlife biologists, as well as numerous veterinarians and hunters, have assisted with these investigations and we are extremely grateful for their support. Below we summarize what is known about LPDV, as well as major knowledge gaps that remain.

LPDV is an oncogenic retrovirus that genetically is most similar to other tumor-causing avian viruses in the genus *Alpharetrovirus*, including avian leukosis virus (ALV) and Rous sarcoma virus (RSV). LPDV has not been isolated in cell cultures used to grow other avian viruses, and this limits research and surveillance. Diagnosis is made by gross and microscopic identification of lymphoid tumors (if present) and polymerase chain reaction (PCR) to detect proviral DNA, which can be further sequenced to confirm the presence of LPDV and characterize the strain genetically. The mechanism of tumor production by LPDV is unknown.

In domestic galliforms, viral-induced tumors are caused by three alpharetroviruses, (ALV, LPDV, and RSV), and by reticuloendotheliosis virus (REV), which is in the genus *Gammaretrovirus* and differs from ALV, LPDV, and RSV genetically. Prior to the 2009 wild turkey cases at SCWDS, natural LPDV infection had been reported only in domestic turkeys in Israel and a few European countries. LPDV-associated lymphoid tumor outbreaks in

domestic turkeys have been rare, with 7-18 week old poult most severely affected. Cumulative flock mortality varies but can reach 25%. Affected turkeys may have an enlarged spleen with a marbled appearance, and pale nodules scattered throughout multiple organs, including liver, kidneys, gonads, intestines, pancreas, and lungs. Tumors consist of neoplastic lymphoid cells, including lymphocytes, lymphoblasts, reticulum cells, and plasma cells.

Experimental trials have shown that LPDV susceptibility varies between domestic turkey strains, and that poults older than one month are more susceptible than one-day-old birds. Experimentally, domestic chickens have been shown to be susceptible to infection and lymphoid tumor development, but natural infections have not been reported. LPDV is considered a poultry pathogen of minor importance because of the rarity of outbreaks and their restricted geographic distribution. The LPDV reservoirs or sources of outbreaks in Europe and Israel are unknown, as are mechanisms of viral transmission, geographic distribution of infected birds without tumors, and other possible health impacts of LPDV infection, such as immunosuppression.

Prior to the LPDV cases at SCWDS, there had been a few reports of lymphoid tumors in wild turkeys. Some of these were associated with REV infection, but no causative virus was identified in most affected birds. After our initial detection of LPDV in wild turkeys, we screened turkeys submitted to our diagnostic service. From 2009 to 2012, we identified 41 PCR-positive turkeys from 18 states; however, only six LPDV-positive turkeys had lymphoid tumors. The other infected turkeys had more common causes of morbidity/mortality, including avian pox, bacterial infection, and trauma. Clinical signs and lesions in the six turkeys with lymphoid tumors were similar to those described in domestic turkeys. All were moribund and exhibited non-specific clinical signs, including weakness, disorientation, and a lack of awareness of humans.

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Tumors consisted of large numbers of neoplastic lymphoid cells in multiple tissues, most commonly in liver, kidney, lung, spleen, heart, and skin.

After identifying a number of LPDV-positive birds among our diagnostic cases, we surveyed hunter-killed wild turkeys from the eastern U.S. by testing for proviral DNA. We detected LPDV in 570 of 1,215 (47%) turkeys and in each of the 18 states that submitted samples. The map shows the broad area where LPDV-positive birds were found through passive surveillance of our diagnostic cases, as well as via active surveillance of hunter-killed birds.

Florida Bans Captive Deer Importation – And So Does New York

Florida recently banned the importation of live, captive deer because of concern for the introduction of chronic wasting disease (CWD). The Florida Fish and Wildlife Conservation Commission (FWC) discussed the issue at its June meeting, but put off a vote on the measure until September in order to evaluate more information and stakeholder feedback. Importation of cervids into the state increased dramatically in 2013, in the face of a possible border closure: 1,007 live cervids,

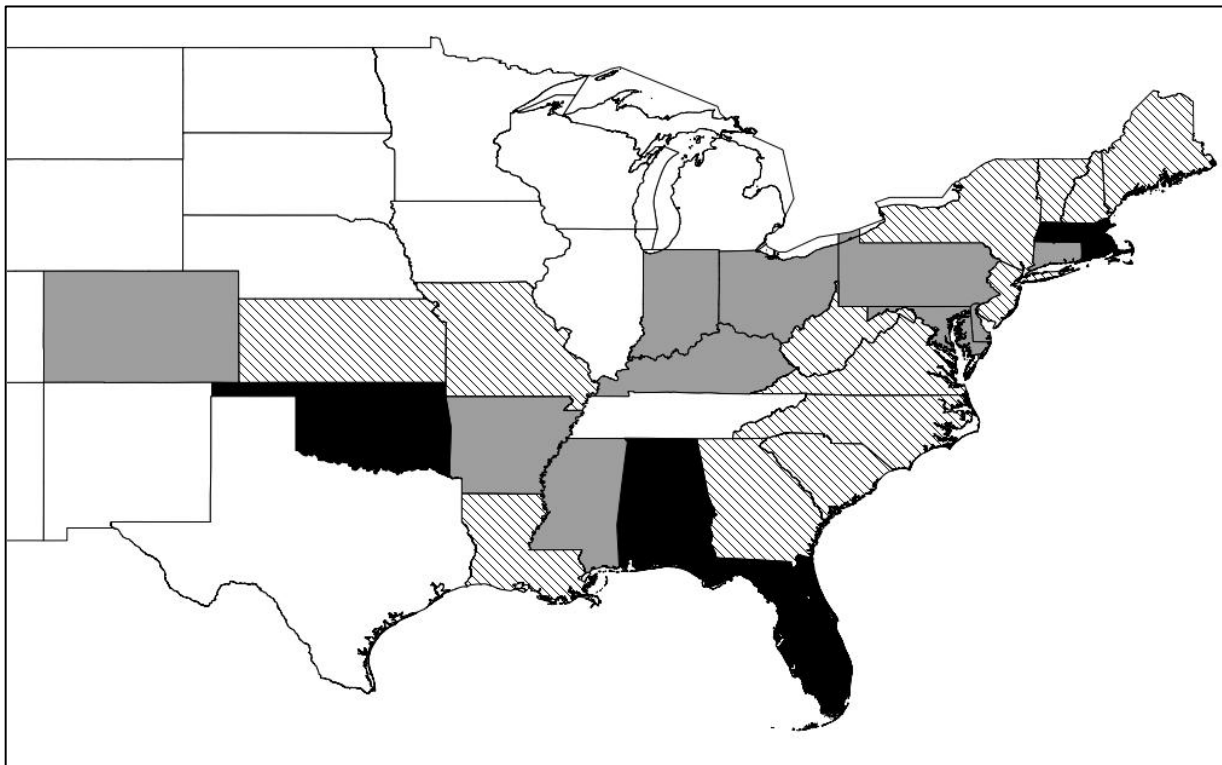


Figure 1. The geographic distribution of LPDV-positive wild turkeys, as detected in hunter-killed birds (black), diagnostic cases (gray), or both (striped).

Our detection of LPDV in wild turkeys with tumors and apparently healthy, hunter-killed birds, are the first reports of this virus in North America. There is more to learn about LPDV, but existing evidence suggests that LPDV infection is widespread in adult Eastern wild turkeys; however, lymphoid tumors are rare, and the clinical significance of infection is uncertain. Many unknowns remain, including the natural history in wild turkeys, its ability to infect other aviary species, its mechanism of transmission of LPDV, and its potential impacts on infected birds and populations. (Prepared by Jesse Thomas and Justin Brown)

including 979 white-tailed deer, were imported into Florida prior to the ban in early September, compared to an annual average of 241 live animals from 2003 - 2012.

The following press release was published by the FWC on September 6, 2013.

The Florida Fish and Wildlife Conservation Commission (FWC) at its Pensacola commission meeting today, Sept. 6, passed a rule prohibiting the importation of live captive deer into Florida from out-of-state sources.

The rule was passed in an effort to reduce the chances of chronic wasting disease (CWD) being introduced into the state. Eighteen other states, including Georgia and Alabama, also prohibit the importation of live cervids (deer, elk and moose).

CWD is not known to affect people but is a contagious neurological disease affecting cervids. It is always fatal, and there is no known cure or vaccine. So far, the disease has been discovered in 22 states, two Canadian provinces, and in South Korea.

To implement the decision immediately, the FWC also issued an executive order prohibiting importation of cervids effective today, Sept. 6, 2013. The order includes limited exemptions for reindeer and zoos.

The Commission also directed the executive director to create a working group to include the industry to develop other measures to safeguard the state from CWD. If these other measures are determined to be sufficient to adequately reduce risk, the Commission gives the executive director authority to then allow importation.

Since the beginning of May, the FWC has received much public comment on this and answered questions and concerns. During this process, those who have deer farms and hunting preserves, hunters and conservationists provided suggestions for additional prevention measures to consider. The Commission used this important feedback to guide its decision making.

For more information on chronic wasting disease, this rule, and the CWD Alliance, go to MyFWC.com/CWD. To see the executive order, go to MyFWC.com/About and select "Inside FWC" then "Executive Director."

LATE BREAKING NEWS: On October 30, 2013, New York's Department of Agriculture and Markets and Department of Environmental Conservation announced an importation ban on live captive cervids susceptible to CWD. In their announcement, the departments cited the importance of protecting the state's wild deer herd, because it contributes \$780,000,000 annually to the economy through associated recreation. The regulation bans importation of live captive black-tailed deer, mule deer, white-tailed deer, red deer, sika deer, elk, and moose from November 16, 2013, through August 1, 2018. The announcement can be found at <http://www.agriculture.ny.gov> (Prepared by John Fischer)

Middle East Respiratory Syndrome

In April of 2012, a novel coronavirus, currently designated Middle East Respiratory Syndrome Coronavirus (MERS-CoV), was detected in a human patient in Saudi Arabia with acute pneumonia and renal failure. To date, 150 cases and 64 deaths (43% fatality rate) have been reported to the World Health Organization (WHO) from nine countries; however, all cases have been linked directly or indirectly through residence or travel in Jordan, Qatar, Saudi Arabia, or the United Arab Emirates. There have been no cases identified in the United States, although several people have been tested.

Symptoms of MERS-CoV infection include fever, cough, and shortness of breath that can progress to severe acute respiratory distress, renal failure, and death. Approximately 20% of patients also develop gastrointestinal symptoms, such as vomiting and diarrhea. An additional 20% of reported MERS infections have resulted in mild or no symptoms.

Coronaviruses (CoV) occur worldwide, are highly infectious, and can be extremely difficult to control, because they have a short generation time and a relatively high mutation rate. They cause mild to severe respiratory, enteric, hepatic and/or neurologic disease in a wide variety of animals, including humans. In 2003, another novel coronavirus, Severe Acute Respiratory Syndrome Virus (SARS-CoV), sickened more than 8,000 humans and had a fatality rate of 10%. Transmission of SARS-CoV to humans is thought to have occurred initially in a live animal market in southern China; however, human to human transmission worsened the outbreak, which occurred in more than 20 countries on four continents. No human cases of SARS have been reported since 2004. Although evidence suggests that SARS-CoV originated in horseshoe bats (*Rhinolophus* spp.), the virus appears to have been transmitted to a Himalayan palm civet (*Paguma larvata*) and then to humans via exposure in an animal market. A recent publication documented finding SARS-like coronaviruses, capable of binding to the specific receptor used by SARS-CoV, in free-ranging horseshoe bats in China.

Epidemiologic investigations continue into potential reservoirs and transmission methods of MERS-CoV to humans. A zoonotic origin for MERS-CoV was suggested earlier by its genetic similarity to some bat coronaviruses, and in August it was reported that a coronavirus with a genomic sequence identical to MERS-CoV was isolated from an

Egyptian tomb bat (*Taphozous perforatus*) in the vicinity of a case in Saudi Arabia. Coronavirus antibodies have been detected in camels; however, the virus has not been isolated from them, making it impossible to determine if the antibodies are against MERS-CoV or another coronavirus. More epidemiologic data linking human cases to infected animals are needed to elucidate the roles of particular species in MERS epidemiology.

The MERS-CoV has spread from ill people to others in close contact, including family members and health care workers, but sustained viral spread in communities has not been observed. The WHO convened an Emergency Committee under the International Health Regulations to evaluate the situation. This committee of international experts determined in July 2013 that the MERS outbreak was not a “Public Health Emergency of International Concern,” although it remained a serious concern. The WHO has not recommended any travel or trade restrictions but continues to review its recommendations as more information becomes available. (Prepared by Jamie Phillips)

“Bullwinkle Deer”

The Southeastern Cooperative Wildlife Disease Study (SCWDS) has been studying the parasites and diseases of white-tailed deer for more than 56 years. With so much time and effort invested in this area, one would think that few surprises would be left, but that doesn't ever seem to be the case. Since 2005, we have received samples from ten deer with oddly deformed muzzles, as well as reports of several other affected deer. The swollen muzzles give them a strange appearance and prompted someone to call them “Bullwinkle deer,” based on their resemblance to the 1960's cartoon character. Although the cases reported to us are uncommon, they occur over a wide geographic area. Affected white-tailed deer have been submitted to SCWDS from as far north as Michigan and as far south as Alabama. The condition also has been confirmed in a mule deer buck in Idaho.

The swollen faces are the result of chronic inflammation in the soft tissues of the muzzle. The inflammation also is seen in connective tissues in the oral cavity, but it is much more severe on the nose and upper lip. All of the deer examined have had similar colonies of bacteria within the inflammatory infiltrates. Attempts to culture the bacteria have been frustrating, possibly due to

chronicity of lesions, freezing and storage of samples prior to submission, and/or excessive growth of secondary bacterial contaminants. Staining characteristics and DNA sequencing of the bacterial colonies observed suggest they differ from other organisms known to cause problems in deer, and investigations continue into their potential role in the development of this condition.



So far, all of the reported cases have been in hunter-killed deer or deer observed in the wild. Some deer have been thin, but there have been no reports of mortality directly attributed to this disease. One landowner reported having seen the same affected deer at a backyard feeder for nearly two years. Many of the deer observed or killed have been known to visit feed sites; however, the association with feeding is anecdotal. At this time, we do not know the factors that may predispose a deer to develop this unusual condition.

The lesions are certainly dramatic, but this disease does not appear to have any negative consequences for deer populations. Cases are relatively infrequent and are not clustered. It is possible that this problem has always occurred in deer, but at a very low prevalence. However, it has become very easy for photographs to be widely circulated among hunters and biologists in a very short period of time since hunters began to use trail cameras and the internet. This rapid sharing of information may have increased the detection and submission of rare and unusual cases, such as the Bullwinkle deer. (Prepared by Kevin Keel, University of California-Davis)

Pansteatitis in a Great Blue Heron

On September 14, 2012, a great blue heron (*Ardea herodias*) found dead on Poplar Island, an interagency habitat restoration site in Chesapeake Bay, Maryland, was submitted by the U.S. Fish and Wildlife Service to SCWDS to determine the cause of death. Although the bird appeared to be in excellent nutritional condition externally, internal examination revealed large accumulations of unusually firm, lobulated, yellow fat over the pectoral muscles and within the coelomic cavity. These abnormal fatty accumulations displaced, sometimes encased the visceral organs. Microscopically, the abnormal fat consisted of adipose cells diffusely surrounded by necrotic debris and granulomatous inflammation. These are classic findings of pansteatitis.



The term “steatitis” refers to inflammation of fat. “Pansteatitis,” also known as “yellow fat disease,” is a severe condition involving most, if not all, of the fat deposits in the body. Pansteatitis has been reported in domestic cats, mink, dolphins, fish, reptiles, and numerous avian species. In fish eating birds, vitamin E deficiency is considered the cause of pansteatitis. Vitamin E is an important antioxidant that protects cells from the damaging effects of metabolic byproducts called free radicals. Deficiencies of this vitamin allow cell membrane damage to occur, leading to tissue necrosis and inflammation, particularly in fat and muscle.

Fish-eating birds are prone to developing pansteatitis, because their diets frequently are high in polyunsaturated fats. These fats are readily oxidized after consumption, and protective antioxidants, such as vitamin E, may become depleted. Additionally, consuming rancid fish can lead to pansteatitis because the fats in rancid fish

already are oxidized, causing further vitamin E depletion. Pansteatitis has been reported in a number of fish-eating birds, including great blue herons, boat-billed herons (*Cochlearius cochlearius*), black-crowned night herons (*Nycticorax nycticorax*), gray herons (*Ardea cinerea*), and at least three egret species (*Egretta thula*, *Mesophoyx intermedia*, and *Ardea alba*).

Pansteatitis was found in herons at Poplar Island in 2001, 2004, and 2005, and a similar diagnosis was made in 1985. There are other factors at this site that may or may not contribute to the recurring diagnosis of pansteatitis in herons. One potential factor is exposure to microcystins, which are toxins produced by some blue-green algae species. Microcystins are hepatotoxic and may have other metabolic and pathologic effects. They have been detected in fresh water reservoirs on Poplar Island, as well as in the livers of other birds with steatitis; however, microcystins were not detected in the bird we necropsied. Another factor potentially involved in the epidemiology of pansteatitis at this site is recurring botulism. To date, no relationships have been identified between microcystins, botulism, and pansteatitis in herons, but investigations continue into the epidemiology of pansteatitis on Poplar Island. (Prepared by Jennifer Ballard)

California Bans Lead Ammo for Hunting

California became the first state to ban lead hunting ammunition on October 11, 2013, when Governor Jerry Brown signed Assembly Law 711 that prohibits the use of lead ammunition when taking wildlife by a firearm. The bill requires the California Fish and Game Commission to promulgate regulations by July 2015 to phase in this ban by July 2019. In his signing message, Governor Brown noted that the danger that lead poses to wildlife has been recognized for more than 100 years, that the U.S. Fish and Wildlife Service prohibited the use of lead for waterfowl hunting nationwide in 1992, and that California has banned hunting with lead ammunition in eight counties within the range of the California condor since 2008.

The California condor is a large scavenging bird that was listed as an endangered species in 1967, and since 1992, it has been the subject of a recovery effort that includes the release of captive-bred birds in portions of the species’ former range. The goal of the California Condor Recovery Plan is to establish two geographically separate populations, each with 150 birds and at least 15 breeding pairs, and today, the birds can be seen in parts of Arizona, California, and Utah, as well as in

Baja California, Mexico. Lead toxicosis, apparently following consumption of spent ammunition in offal and carcasses of hunter-killed animals, is believed to be one issue affecting the success of condor recovery efforts, and wildlife management agencies have been addressing this risk through voluntary or mandatory use of non-toxic ammunition for hunting game and nongame wildlife within condor range.

Governor Brown's signing message also mentioned the concern he has that the bill leaves the impression "...that hunters and sportsmen and women in California are not conservationists. I know this is not the case. Hunters and anglers are the original conservationists. Since the 1930s, hunters have done more than any other community to conserve species and their habitats, and that is a lasting conservation legacy."

An amendment to the bill authorizes the Director of the California Department of Fish and Wildlife to suspend the statewide ban on lead ammunition if the federal government prohibits non-lead ammunition because it is considered armor-piercing. Another amendment permits the presence of trace amounts of lead in certified non-lead ammunition to avoid enforcement and compliance concerns. The complete signing message can be accessed at: http://gov.ca.gov/docs/AB_711_2013_Signing_Message.pdf. (Prepared by John Fischer)

Why More Americans Are Hunting

Responsive Management (RM) recently reported that obtaining meat is an increasingly important reason for hunters to go afield, and it is a key factor in the increase in hunting participation in the U.S. since 2006. Responsive Management is an internationally recognized public opinion and attitude survey research firm specializing in natural resource and outdoor recreation issues. More information on RM can be found at its website: <http://www.responsivemanagement.com/>.

In 2013, a nationwide survey by RM of adult hunters asked them about their single most important reason for hunting in the prior year. Respondents could choose from a list that contained "being with family and friends, being close to nature, for recreation, for meat, or for a trophy." The most frequent reason was obtaining meat: 35% indicated that hunting for the meat was their primary motivation, representing a 13% increase over results from a 2006 survey. Other reasons for hunting declined or remained the same over the same time period.

One reason for the increased emphasis on obtaining meat is the economic recession. Since it began in 2008, the recession has left few families untouched, and more Americans have turned to hunting as a way of obtaining inexpensive meat. In their 2013 nationwide study, entitled *Exploring Recent Increases in Hunting and Fishing Participation*, RM reported that 48% of hunters said that hunting "to save money in a bad or declining economy" was either a major or minor influence in their participation. Furthermore, a 2013 RM survey of Georgia hunters found that 51% listed obtaining the meat as their primary reason for hunting in the two previous years, up from 26% in a 2004 survey.

Another link between the economy and hunting participation was revealed by RM in 2008 when it investigated a long list of factors that potentially were correlated with hunting participation. Variables ranged from average monthly temperature to the Dow Jones Industrial Average and median income, but only two were found to be statistically significant: hunter age and housing starts. Hunting participation decreased when the proportion of hunters aged 65-69 increased, and it also decreased as housing starts increased. A nationwide hunter survey by RM and the National Shooting Sports Foundation in 2007 had found that the top occupation among employed hunters was construction and other building trades. When times are good and housing starts are up, fewer construction workers have time to hunt; however, when housing starts are down and construction workers are unemployed, there's more time to hunt and a need to put inexpensive meat on the table.

Another reason for increased hunting participation and the growing emphasis on obtaining meat is a greater number of female hunters. In their 2013 survey, RM found that 13% of new or returning hunters were women, compared to only 9% of those who classified themselves as previously established hunters. Interestingly, RM also reported that 55% of female hunters indicated their principle motivation for hunting was acquisition of meat, compared to 27% of male hunters. Since women are more likely to hunt for meat than recreation, the increase in female hunters partially explains the shift toward "utilitarian" hunting.

An explanation for increased female participation may be that women are simply joining friends or family members as overall hunting activity increases. Alternatively, expanding opportunities for women, including female-only hunting seasons on public wildlife management areas and female-oriented instructional programs, such as the

National Wild Turkey Federation's Women in the Outdoors and state-sponsored Becoming an Outdoors Woman workshops, may be encouraging women to try hunting.

A third factor cited by RM as contributing to a rise in hunting participation is the "locavore" movement. Locavores are people who endeavor to consume food raised solely, or at least principally, in their immediate geographic area. This social and culinary trend has grown quickly and has spawned innumerable farmers' markets, community gardens, and locavore restaurants. The general principle behind the movement is to improve dietary quality, bolster local economies, and decrease the environmental impact of food production. Along with these newer approaches, the locavore movement has encouraged a return to many traditional practices, including seasonal vegetable gardens, canning, and hunting.

The 2013 RM survey found that 68% of participants indicated "interest in hunting as a local, natural, or 'green' food source" was either a major or minor influence in their decision to hunt. This was the single highest ranking factor identified in the study. The RM report also associated the popularity of the locavore lifestyle with increasing interest in urban hunting and cited a 2009 *New York Times* article entitled "The Urban Deerslayer" that described parallel rises in food awareness and interest in hunting among young urbanites.

In conclusion, the RM report clearly shows an exciting uptrend in hunter participation for a number of diverse and unexpected reasons. It serves as a reminder that there are many future hunters out there just waiting for someone to teach them, and we all have a responsibility to share what we know. (Prepared by Jennifer Ballard)

2013 Annual WDA Conference

The SCWDS building was nearly empty this year during the last week of July, as many of us attended the annual Wildlife Disease Association's (WDA) conference at Knoxville, Tennessee. Approximately 20 SCWDS faculty, students, and staff took part in the conference, providing 14 oral and 17 poster presentations. If you were to count

all folks previously trained or employed by SCWDS at the meeting, the list would be twice as long.

Albert Mercurio, a doctoral student working with Dr. Sonia Hernandez, received the WDA's Terry Amundson Student Presentation Award for his presentation titled: *An Experimental Trial Induces Avian Vacuolar Myelinopathy Clinical Signs and Lesions in Painted Turtles (Chrysemys picta)*. In this project, Mr. Mercurio described the development of AVM-like clinical signs and lesions in painted turtles after receiving a diet of aquatic vegetation collected from a reservoir during an AVM outbreak. Vegetation and associated epiphytes from this reservoir previously was used to produce AVM in chickens, an animal model for AVM developed several years ago at SCWDS.

Dr. Jenn Ballard's landscape photograph of John's Island, Nova Scotia, placed third in the WDA's first Photo Contest, an event designed to raise money for the organization. Jenn took the picture in May 2013 while investigating Wellfleet Bay virus in the common eider, as part of her dissertation research.

SCWDS faculty members were deeply involved in the scientific content of this year's conference. Michael Yabsley and Sonia Hernandez were Session Chairs for the *Linking Disease Ecology with Wildlife Health* Session, judging submitted abstracts and moderating the session, and Sonia instructed the American College of Zoological Medicine Ultrashort Course.

Members of the University of Georgia's (UGA) student chapter of WDA were extremely active at the conference this year. Several members volunteered to work at the WDA registration desk, help with the lecture sessions during the meeting, and work at the UGA student WDA table selling our club's t-shirts and pint glasses (and raising \$300 in the process). Finally, the WDA's Student Affairs Committee selected the UGA student WDA chapter to receive funding for student chapter activities in 2013-2014. Congratulations to such an active group: it speaks well of the "bottom-up" dedication to wildlife diseases at UGA and instills in us great optimism for the future of the WDA and the field of wildlife health. (Prepared by Sonia Hernandez)

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